UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

JUN 01 2006 In reply refer to:
151422SWR2005SA00838:SAW

Scott Hamelberg
Project Leader
U.S. Fish and Wildlife Service
Coleman National Fish Hatchery Complex
24411 Coleman Fish Hatchery Road
Anderson, California 96007

Dear Mr. Hamelberg:

This document transmits NOAA's National Marine Fisheries Service's (NMFS) final biological opinion based upon the review of the proposed U.S. Fish and Wildlife Service's (USFWS) Coleman National Fish Hatchery (Coleman NFH) Fish Barrier Weir and Ladder Modification project located in lower Battle Creek at RM 5.8, in Shasta County, California, and its effects on endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), and threatened Central Valley steelhead (*O. mykiss*), and the designated critical habitat of Central Valley spring-run Chinook salmon and Central Valley steelhead, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*; Enclosure 1). Your December 16, 2005, request for formal consultation was received on December 20, 2005.

This biological opinion is based on information provided in the December 2005 Action Specific Implementation Plan for the proposed project; several meetings and telephone conversations between NMFS staff and representatives of the USFWS, Bureau of Reclamation (Reclamation), and California Department of Fish and Game (CDFG); and other sources of information, including site visits. Additionally, USFWS requested and reviewed a draft of this biological opinion (dated May 18, 2006), and the final biological opinion reflects changes based on comments contained in a letter dated May 26, 2006, addressed from Scott Hamelberg of USFWS to Rodney R. McInnis of NMFS. Changes to the biological opinion requested in the May 26, 2006, letter were edits, corrections, and clarifications primarily to specific details of the project description. Therefore, all requested changes were made, leaving NMFS's analysis of the effects of the project on listed salmonids and designated critical habitat essentially unchanged. A complete administrative record of this consultation is on file at the NMFS Sacramento Area Office.

Based on the best available scientific and commercial information, the biological opinion concludes that the Coleman NFH Fish Barrier Weir and Ladder Modification project is not likely to jeopardize the continued existence of the above listed species, or destroy or adversely modify designated critical habitat. NMFS also has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to minimize incidental take associated with the project.

Also enclosed are essential fish habitat (EFH) conservation recommendations for Pacific salmon as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended (16 U.S.C. 1801 *et seq.*; Enclosure 2). This document concludes that the Coleman NFH Fish Barrier Weir and Ladder Modification project will temporarily adversely affect EFH for Pacific salmon in the action area. Therefore, NMFS has identified pertinent EFH conservation recommendations as addressed in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan.

Section 305(b)4(B) of the MSA requires USFWS to provide NMFS with a detailed written response within thirty days, and ten days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by USFWS for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR 600.920[j]). In the case of a response that is inconsistent with our recommendations, USFWS must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

If you have any questions regarding this document, please contact Ms. Shirley Witalis in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Ms. Witalis may be reached by telephone at (916) 930-3606, or by Fax at (916) 930-3629.

Sincerely,

Russell M Strach

Rodney R. McInnis
Regional Administrator

Enclosures (2)

Enclosure 1

BIOLOGICAL OPINION

ACTION AGENCY: U.S. Fish and Wildlife Service

ACTIVITY: Coleman National Fish Hatchery Fish Barrier Weir and Ladder Modification Project

CONSULTATION CONDUCTED BY: Southwest Region, National Marine Fisheries Service

DATE ISSUED: May 31, 2006

I. CONSULTATION HISTORY

On January 25, 1999, the National Marine Fisheries Service (NMFS) received a copy of the project proposal submitted by the U.S. Fish and Wildlife Service (USFWS) to the California Bay Delta Authority (CALFED), dated January 15, 1999, for funding of improvement to the Coleman National Fish Hatchery (Coleman NFH) fish ladder, and modifications to the barrier weir.

On April 26, 1999, NMFS received a copy of an internal USFWS memorandum, dated April 9, 1999, regarding the proposal to improve anadromous fish passage to upper Battle Creek and modification of the barrier weir.

On May 30, 2000, NMFS received a letter of invitation from USFWS, dated May 24, 2000, to participate in discussions on the operating strategy for the Coleman NFH barrier weir. NMFS joined an interagency/stakeholder technical team which met throughout years 2000 through 2005, for the purposes of developing criteria for a new fish ladder and weir design.

On January 24, 2003, NMFS received the preliminary concept study report for the proposed Coleman NFH Fish Barrier Weir and Ladder Modification project.

On March 17, 2003, NMFS received a copy of a letter, dated March 13, 2003, from the California Department of Fish and Game (CDFG) to the U.S. Bureau of Reclamation (Reclamation), containing CDFG's comments on the preliminary concept study report.

On August 28, 2003, NMFS received a file report from Reclamation, dated August 25, 2003, concerning geologic, soil, and groundwater studies associated with the proposed project.

On October 21, 2003, NMFS received a supplement to the draft concept study report from Reclamation.

On January 24, 2004, the CALFED Science Panel issued the report, *Compatibility of Coleman National Fish Hatchery Operations and Restoration of Anadromous Salmonids in Battle Creek*, which concluded that the Coleman NFH Barrier Weir and Fish Ladder Modification project was necessary to the success of the Battle Creek Salmon and Steelhead Restoration project.

In June 2004, Reclamation and USFWS released for public review and comment, a draft Environmental Assessment (EA) and draft Finding of No Significant Impact (FONSI) for the proposed Coleman National Fish Hatchery Barrier Weir and Ladder Modification project.

On October 29, 2004, NMFS sent a letter of support to Reclamation on the need to include the Coleman NFH Barrier Weir and Fish Ladder Modification project as part of a suite of actions intended to promote sustainable salmon and steelhead populations in a restored 48-mile section of salmonid habitat in upper Battle Creek.

On March 15, 2005, NMFS received the administrative draft biological assessment for the proposed project dated March 15, 2005.

On March 22, 2005, NMFS received a Planning Aid Memorandum, dated March 18, 2005, on the proposed project from the Sacramento Fish and Wildlife Office, Sacramento.

On August 31, 2005, NMFS received the draft technical specifications and drawings for the proposed project dated August 29, 2005, from Reclamation.

On December 20, 2005, NMFS received a consultation initiation package from USFWS. The package contained a letter dated December 16, 2005, requesting initiation of formal section 7 consultation and the opportunity to review a draft of the biological opinion prior to the completion of the consultation process; the final Action Specific Implementation Plan (ASIP; *i.e.*, biological assessment; Reclamation and USFWS 2005) for the project; and a courtesy copy of the internal memorandum on the request for USFWS concurrence with a “not likely to adversely affect” determination for ESA-listed species found within the project area which are under USFWS jurisdiction. Consultation was initiated on December 20, 2005.

On February 7, 2006, NMFS received a draft Fish and Wildlife Coordination Act Report for the proposed project. The report stated that the measures incorporated into the proposed project description would be adequate to prevent loss or damage to, and provide development and improvement of fish and wildlife resources.

On April 6, 2006, Reclamation and the USFWS released an updated Draft EA and Draft FONSI for the proposed project for a 30-day public review and comment period. On April 6, 2006, a news release was mailed by Reclamation to NMFS notifying NMFS of the public release of this document. On April 11, 2006, an electronic copy of the document was forwarded to NMFS.

On May 18, 2006, NMFS issued a draft biological opinion assessing the effects of the proposed action on listed salmonids and designated critical habitat. On May 26, 2006, USFWS provided NMFS with written comments on the draft biological opinion.

II. DESCRIPTION OF THE PROPOSED ACTION

The U.S. Fish and Wildlife Service, working cooperatively with Reclamation, proposes to improve fish passage management capabilities on Battle Creek at the Coleman NFH fish barrier weir and ladder by increasing the efficiency at which anadromous fish can pass upstream when allowed, and of blocking unwanted upstream fish passage. The proposed project is intended to improve the ecological function of Battle Creek upstream of the Coleman NFH barrier weir, in particular by ensuring the ability to selectively manage fish passage past the Coleman NFH. This will improve, for example, the ability to maintain isolation between the Central Valley spring- and fall-run Chinook salmon spawning populations to retain the genetic integrity of both runs, as restoration in upper Battle Creek is being implemented. It is one in a series of modifications intended to restore natural fish runs into the upstream reaches of Battle Creek. The restoration of upper Battle Creek would contribute to the recovery of the Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley spring-run Chinook salmon (*O. tshawytscha*) Evolutionarily Significant Units (ESUs), and the Central Valley steelhead (*O. mykiss*) Distinct Population Segment (DPS), by providing access to quality habitat for expansion of spatial structure for all three species.

The project site is located 5.8 river miles (RM) upstream of the confluence of Battle Creek and the Sacramento River (RM 271.5), adjacent to Coleman NFH, located at latitude 40^{o} 23’ 54’ N, longitude 122^{o} 8’ 43” W (U.S. Geological Service Quad Balls Ferry, California). Approximately 2.2 acres (800 linear feet) of montane riverine aquatic habitat is delineated on the project site. The proposed modification to the barrier weir will provide the capability of blocking fish migration up Battle Creek at flows up to 800 cubic feet per second (cfs), and allow selective passage management at least equal to that provided by proposed ladders planned for upstream dams at flows up to 3,000 cfs, the flow at which the stream overflows its banks. The proposed actions are consistent with the USFWS’s 2001 Final Restoration Plan for the Anadromous Fish Restoration Program (AFRP), and supported by the Battle Creek Salmon and Steelhead Restoration Working Group and the California Bay Delta Authority (CALFED). The project also contributes to the conservation goals of the CALFED Multi-Species Conservation Strategy (MSCS; CALFED 2000a), and addresses adverse effects to CDFG’s Natural Community Conservation Plan (NCCP) montane riverine aquatic community complex of anadromous salmonids.

A. Project Activities

Proposed project activities include the modification of the existing barrier weir by adding a 2-foot-wide, lipped crest cap and an overshot gate, which will provide the capability to block the passage of 100 percent of upstream migrating salmonids at flows up to 800 cfs. Fish ladder modifications will include constructing a new ladder structure containing two forks, one leading directly to the existing Coleman NFH adult holding ponds and the other providing access to Battle Creek upstream of the barrier weir. Additional modifications will include features to enable lamprey (*Lampetra* spp.) to move above the barrier weir and fish ladder structure.

The existing fish ladder will remain to provide attraction flow to the proposed new ladder entrance, and the second ladder leading to the adult holding ponds will be decommissioned and demolished. The design flow through the new fish ladder system will be 60 to 90 cfs, and provide attraction flows of 10 percent of Battle Creek flows, up to 300 cfs, based on a maximum creek flow of 3,000 cfs. The new fish ladder system will also be designed to accommodate the installation of an electronic fish sorting and monitoring system without major structural changes.

The project footprint (Figure 1) is approximately 7.6 acres (ac), consisting of: Battle Creek dewatered, 0.9 ac; south side island work area, 0.5 ac; diversion channel, 1.2 ac; diversion channel spoil pile, 1.6 ac; contractor area, 2.3 ac; cofferdam access roads, 0.2 ac; fish ladder construction area, 0.4 ac; staging area, 0.3 ac; and north side access roads, 0.2 ac.

1. Construction Schedule

Construction will be carried out within three work seasons, beginning in 2006, with instream actions to be carried out between June 1 and September 30. Actual construction sequencing by season is at the discretion of the contractor, but one possible timeframe for implementation is as follows:

a. *Season 1*

The following activities are expected to occur:

- **Modifications will be made to the fish ladder on the north side of Battle Creek,** including excavation and concrete work for construction of both the “river” and “mid-junction” sections of the ladder. Work will be conducted in the dry, outside of the active Battle Creek channel, and may require placement of one or two cofferdams, each constructed of approximately 500 cubic yards of gravel. The fish ladder cofferdams will be partially removed at the end of the instream construction window, leaving the bottom one foot of spawning gravel instream, as measured from the channel bed upward. A dewatering system will be used to remove seepage from excavated areas.

- **A diversion channel will be partially excavated on the south bank of Battle Creek** to dewater the project area upstream and downstream of the barrier weir during the second and third construction seasons. Excavation will be done in the dry and work will be accomplished using excavators, backhoes, bulldozers, and dump trunks. To gain access to the south side, equipment will either ford the creek or use a stream crossing with culverts. If a stream crossing is used, design specifications will follow NMFS Southwest Region’s guidelines (NMFS 2000). Any stream crossing will be removed at the end of the instream construction window.

b. *Season 2*

The following activities are expected to occur:

- **The excavation of the south bank diversion channel will be completed.** The diversion channel will be approximately 600 feet in length with an excavated volume of approximately 12,000 cubic yards.

- **Upstream and downstream diversion channel cofferdams will be constructed, and flows directed into the diversion channel, and the project area dewatered.** The cofferdam foundation dimensions will be 80 feet long by 20 feet wide by 3 to 5 feet deep, and require placement of approximately 200 cubic yards of material. The upstream diversion channel cofferdam will be constructed of approximately 600 to 1,000 cubic yards of spawning gravel, and the downstream diversion channel cofferdam constructed of approximately 1,000 cubic yards of spawning gravel. Both cofferdams will be partially removed at the end of the instream construction window, leaving the bottom one-foot of spawning gravel left instream to improve spawning habitat quality and quantity.

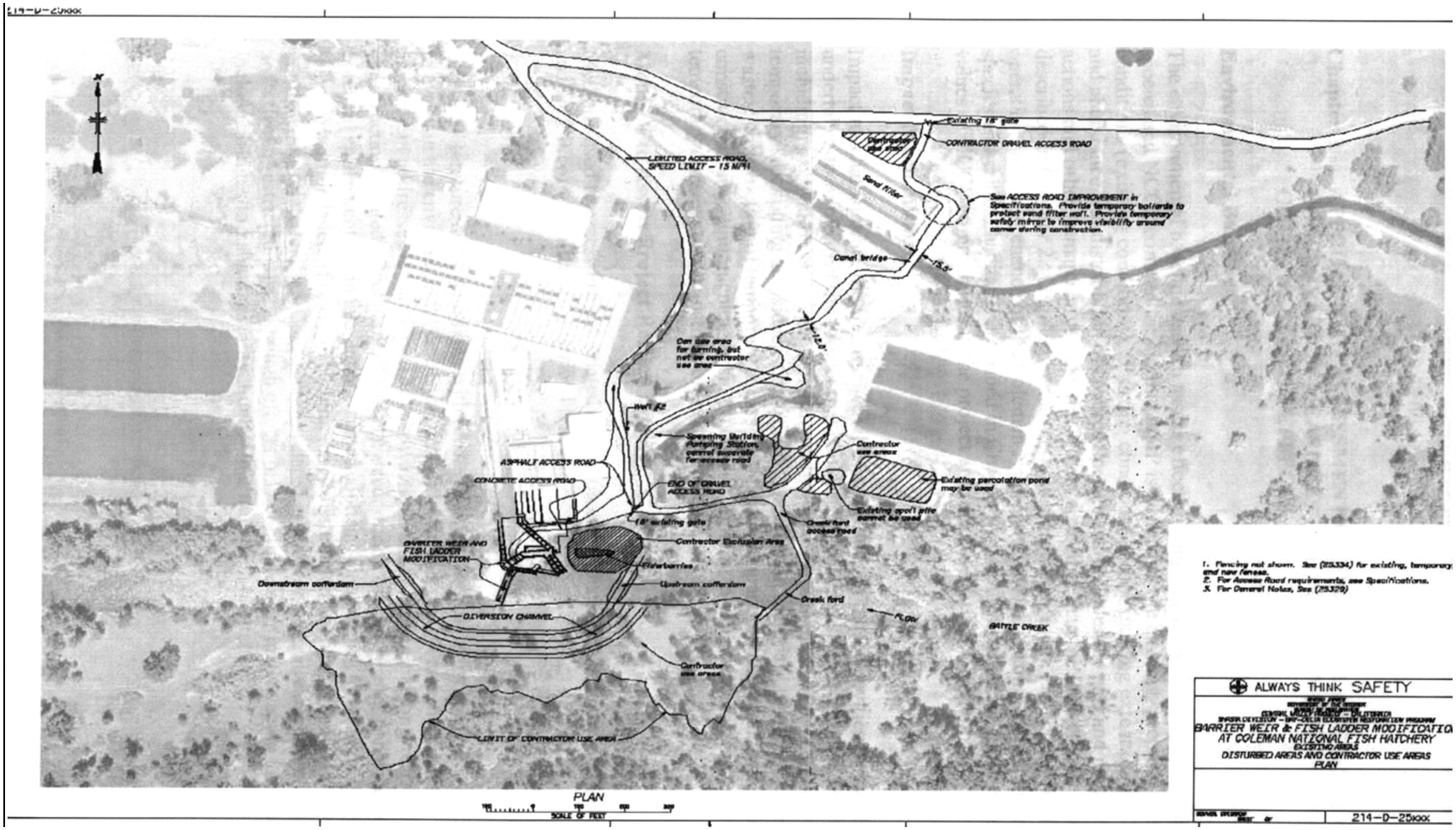
- **A picket weir will be installed** at the downstream end of the diversion channel to block the upstream passage of fish, from August 1 to October 1.

- **Excavation and concrete work for construction of the entrance and hatchery section of the ladder on the north side of Battle Creek will be completed.** Work will be conducted in the dry, outside of the active Battle Creek channel, and may require placement of one or two spawning gravel cofferdams, each consisting of approximately 500 cubic yards of material. Each cofferdam will be removed at the end of the instream construction window, with the exception of the bottom one-foot foundation, as measured from the channel bed upward. A dewatering system will be used to remove seepage from excavated areas.

- **The crest cap and overshot gate will be added to the existing barrier weir.**

- **The cofferdams will be partially removed by September 30.** The upstream and downstream sections of the diversion channel will be plugged. Both the upstream and downstream diversion channel cofferdams will be partially removed at the end of the

Figure 1. Plan view showing overall Project area and Project features.



instream construction window, with the exception of the bottom foot of foundation gravel.

c. *Season 3*

The following activities are expected to occur:

- **The southbank diversion channel will be re-occupied** by removing plugs, upstream and downstream diversion channel cofferdams, and Battle Creek flow diverted into the diversion channel. The project area subsequently will be dewatered.

- **Remaining minor modifications to the fish ladder, crest cap, and overshot gate will be completed.**

- **The diversion channel will be backfilled, and both upstream and downstream diversion channel cofferdams will be partially removed** at the end of the instream construction window, with the exception of the bottom foot of foundation gravel.

- **The diversion channel and other impacted riparian and upland sites will be restored** to pre-project conditions by replanting and/or reseeding. Standard erosion control measures will be used to prevent erosion as stipulated in conditions of permits acquired for the project.

- **A picket weir will be installed** at the downstream end of the diversion channels to block the upstream passage of fish, from August 1 to October 1.

2. <u>Construction Considerations and Affected Area</u>

- **Access trail construction.** Construction of the cofferdam access road and the north side access roads will involve clearing vegetation and some excavation. Total area affected will be approximately 0.4 acres (17,424 square feet) on the grounds adjacent to Battle Creek.

- **Diversion channel construction.** The scope of the constructed diversion channel will include approximately 1.2 acres (52,272 square feet, 600 linear feet) of Battle Creek and its south bank.

- **Cofferdam construction.** Construction of a temporary cofferdam will involve the dewatering of approximately 0.9 acres (39,204 square feet, 525 linear feet) of Battle Creek.

- **Diversion channel spoil pile.** Excavated channel material covering an area of 1.6 acres (69,696 square feet) will be deposited on the grounds adjacent to Battle Creek.

- **Ladder construction.** The footprint of the concrete apron and fish ladder will cover approximately 0.4 acres (17,424 square feet) of Battle Creek.

- **Work areas.** The south side island work area, contractor area south side, and staging area will cover approximately 3.1 acres (135,036 square feet) on the grounds adjacent to Battle Creek.

- **Construction materials.** All materials used for construction of in-channel structures will meet applicable State and Federal water quality criteria standards.

3. <u>Gravel Harvesting and Processing Methods</u>

Gravel will be collected from a source outside the active stream channels at or above the 100-year flood plain, or from an out-of-basin source. Cofferdams will be constructed of clean, uncrushed, rounded natural river rock spawning gravel that follows established Central Valley Project Improvement Act (CVPIA) and CALFED standards for restoration projects. Gravel will be sized such that 100 percent will pass through a 4-inch sieve, 80 to 90 percent will pass through a 3-inch sieve, 50 to 60 percent will pass through a 1.5-inch sieve, 0 to 10 percent will pass through a No. 4 sieve, and 0 to 5 percent will pass through a No. 200 sieve (Scott Hamelberg, USFWS, pers. comm., May 26, 2006). All gravel will be washed at least once and have a cleanliness value of 90 or higher, based on Caltrans Test #227.

4. <u>Access Routes</u>

It will be necessary to transport the gravel to the project area, and place it within the creek to function as temporary cofferdams. The creek will be accessed via a temporary channel corridor which may be either excavated from the creek substrate and bank, or constructed with culverts. A gravel ramp may be constructed leading into the creek to provide access for haulers and to minimize damage to the stream bank. To minimize impacts to water quality, equipment and machinery coming in contact with water will be inspected daily and be completely free of grease, oil, petroleum products, or other nonnative materials. A Spill Prevention and Countermeasure Plan (SPCP) will be developed in coordination with the RWQCB through the section 401 Clean Water Act permitting process (see *Proposed Conservation Measures*, below).

Gravel and equipment will be transported over approximately 0.1 acre of temporary access routes between the existing gravel roads and the construction site. The temporary access routes would be over non-irrigated montane riparian vegetation, and will not be altered except where woody vegetation may need to be trimmed or cut to access the in-river construction site.

5. <u>Diversion channel</u>

Dewatering of Battle Creek will be implemented so that fish will have the ability to migrate past the project area. To offset possible delays in out-migration, the diversion channel has been designed to match the water depth and velocity parameters of Battle Creek. At the completion of the project, the channel and cofferdams will be deconstructed and the supporting structures will be removed. The diversion channel will be filled to restore the south bank topography to its pre-project condition after the construction is completed, in coordination with the U.S. Bureau of Land Management (Reclamation and USFWS 2006).

6. Blasting Activity

Although unlikely, project construction may involve blasting to dismantle the existing structures and material (concrete, gravel, and rock) from the footprint and bedrock, and constructing new facilities related to the fish ladder. It is expected that all blasting will be done in the dry or on land; no underwater blasting has been proposed. The Battle Creek Salmon and Steelhead Restoration project is following the Canadian Department of Fisheries and Oceans' "*Guidelines for the Use of Explosives in Canadian Fisheries Waters*" (Wright and Hopky 1998) for on-shore setback distances from fish habitat based on substrate type to meet the maximum pressure guideline of 100 kilopascals (kPa) to avoid physical impacts to fish, based on the weight of the charge used (NMFS 2005). It is expected that the current project will follow suit in consulting the guidelines, should it be necessary to carry out blasting as a construction action.

7. Pile Driving and Dredging

Although unlikely, pile-driving or dredging may be used to construct the cofferdams. If pile-driving or dredging must be used, suspension of sediments in the water will be minimized by the use of BMPs; turbidity will not exceed the limits established by the RWQCB. To monitor the project for noise and shock disturbance effects of dredging and possible sheet-piling, a hydrophone will be placed within the area's water perimeter to monitor sound waves. In-water sound waves shall not be greater than 120 decibels within a 10-meter radius and 1-meter deep. A "bubble curtain" or other equally effective method shall be used to mitigate sound waves to the required levels.

8. Restoration of Disturbed Habitat

Disturbed habitat will be restored upon completion of the project. Natural woody riparian and shaded riverine aquatic (SRA) habitat will be avoided or preserved to the maximum extent practical. Riparian species within the project area are primarily composed of native blackberry thickets (*Rubus vitifolius*), cottonwoods (*Populus fremontii*) and willows (*Salix spp.*). Disturbed riparian areas, including places where exotic species are eradicated or where native woody species are removed to provide access routes, will be planted with native vegetation to prevent no net loss of habitat. Planted areas will be monitored, and if revegetation is unsuccessful, will be replanted within three years time. A Wetland and Riparian Mitigation and Monitoring Plan will be used to evaluate the adequacy of the re-establishment of the function and value of wetlands, riparian habitat, and upland habitat impacted or lost due to project construction (see below).

B. Proposed Conservation Measures

The following conservation measures are incorporated into the project and will be implemented before and/or during the project construction activities to avoid or minimize impacts to listed fish species (see Table 8-1 of the ASIP for a complete list of conservation measures). Resource monitors will conduct surveys as appropriate for threatened, endangered and special-status species. All contracted parties will coordinate construction actions with Coleman NFH operations, and they will be given a list of agency contacts for referral and notification items.

1. Develop and Implement a Worker Environmental Education Program

Construction contractor personnel will be required to participate in and comply with an awareness training regarding government and local environmental laws and permits; penalties for non-compliance with environmental requirements and conditions; endangered, threatened, and special status species, and their habitats; awareness and avoidance of environmentally sensitive areas (exclusion zones); protection of cultural resources; and environmental protection measures, mitigation, compensation, and restoration.

2. Implement Environmental Conditions as Specified in Project Permits

Project applicants are responsible for the implementation of environmental conditions in all permits relating to the project, including the ESA; California Endangered Species Act (CESA); NCCP; Clean Water Act, Sections 401 and 404; and the Regional Water Quality Control Board (RWQCB) Construction Stormwater and Dewatering Permits.

3. Designate Work and Exclusion Zones

Designated work and exclusion zones will clearly flagged and staked, including designated access roads and sensitive areas that are to be avoided. During construction, job inspectors and resource monitors will ensure that construction equipment and ancillary activities avoid any disturbance of sensitive resources outside the designated work zones.

a. *Work Zones*

- Use and storage of construction equipment will be confined to designated work zones.
- To the extent possible, work zones will incorporate existing roads and access points to minimize disturbance to the environment and wildlife.
- Staging areas, borrow material sites, parking locations, stockpile areas, and storage areas will be located outside of designated environmentally sensitive areas and will be clearly marked and monitored.
- Excavation, filling, and other earthmoving activities will be done gradually to allow wildlife to escape in advance of machinery and advancing soil.

b. *Exclusion Zones*

- Environmentally-sensitive habitat of habitat special-status species will be delineated in the field. Exclusion zones will be demarcated by brightly colored construction fencing or flagged ropes, with signage identifying environmentally sensitive areas.

- Fencing will be installed prior to construction and will be maintained throughout the construction season.

- The following paragraph will be included in the construction specifications for environmentally sensitive areas:

  The contractor's attention is directed to the areas designated as "Environmentally Sensitive Areas." These areas are protected, and no entry by the contractor for any purpose will be allowed unless specifically authorized. The contractor shall take measures to ensure that the contractor's employees do not enter or disturb these areas, by issuing written notice to employees and subcontractors regarding compliance with restrictions for environmentally sensitive areas.

4. Use of an Instream Work Window

All instream work relating to the project will take place within an established work window of June 1 through September 30, in order to avoid or minimize harm to salmon and steelhead during crucial spawning and incubation periods.

5. Implement a Fish Rescue Operation

Approximately 0.9 acres of Battle Creek will be dewatered during each construction season. The feasibility of net blocking Battle Creek to prevent fish access into the dewatered section of the creek prior to cofferdam construction will be evaluated prior to dewatering activities. Biologists will snorkel or dive in the affected area to monitor possible adult and juvenile fish stranding, and insure that fish rescue operations will be carried out as necessary. Each fish rescue team will be comprised of two to four fishery biologists experienced in the use of seines and electroshockers. There will be a maximum of two teams removing and transporting fish from the dewatered area, as follows:

a. *Rescue of Juvenile Fish*

- A minimum of 3 passes with a seine though each stranding location, continuing until all fish are removed;

- after each pass, captured fish will be transferred into aerated, 5-gallon buckets or holding in-river in perforated buckets; and,

- upon recovery, fish will be transported downstream of the project area.

b. *Rescue of Adult Fish*

- A minimum of 3 passes with a seine though each stranding location, continuing until all fish are removed;

- after each pass, captured fish will be placed into appropriate-sized containers and immediately transported and released upstream of the project area.

If the rescue teams determine that all of the trapped fish cannot be rescued by seining, a fishery biologist with professional experience in the methodology will implement electroshocking under NMFS guidelines (NMFS 2000) to minimize the risk to salmonids. Fish rescue teams will collect data on all fish captured, including species identification and length, and will note the total number rescued and any mortality for purposes of reporting to NMFS and CDFG.

6. Environmental Planning

Several plans incorporating Best Management Practices (BMPs) to avoid or minimize risks to listed fish and designated critical habitat will be developed prior to implementation of the project and in coordination with pertinent regulatory agencies. Specific BMPs and avoidance and minimization measures will be consistent with the goals of CALFED's MSCS, CDFG's NCCP, and lamprey passage needs for accessing habitat above the weir in Battle Creek. The CALFED ERP for the Sacramento River Ecological Management Zone calls for maintaining and restoring lamprey population distribution and abundance to higher levels than at present (CALFED 2000)

A Storm Water Pollution Prevention Plan (SWPPP) is intended to avoid or minimize the potential for sediment input into aquatic systems, and will be part of the National Pollution Discharge Elimination System General Construction Activity Stormwater Permit for the project. The SWPPP will contain contingency measures, details about contractor responsibilities, and lists of responsible parties and agency contacts. In addition, the project will implement the following measures:

- Monitor water quality for turbidity and settleable materials according to the RWQCB section 401 Water Quality Certification standard conditions.

- When Battle Creek is diverted through the diversion channel, the associated cofferdams and diversion channel will be constructed in a manner that will avoid or minimize sediment discharges. Methods may include, but are not limited to, the use of clean/washed spawning-sized gravel, riprap placement, and geotechnical fabric.

- Temporary sediment control measures will be located at disturbed areas to prevent sediment from entering Battle Creek. These measures will be kept in place until disturbed areas are stabilized.

- Disturbed soils will be sprayed with water to minimize wind erosion or dust during construction.

- Interim measures to control erosion and sedimentation over winter will include BMPs. Methods may include, but will not be limited to, the use of mulch, straw wattles, and silt fences. All measures will be specified in coordination with an erosion control specialist and adhere to the RWQCB Construction Stormwater Permit.

- At the conclusion of the project, disturbed soils will be stabilized and revegetated using BMPs, in coordination with an erosion control specialist, and as dictated by the RWQCB Construction Stormwater Permit. To the greatest extent possible, disturbed soils will be reseeded or replanted with native plant species.

- BMPs will be monitored after project completion and necessary repairs conducted so that disturbed areas are adequately stabilized similar to pre-project conditions.

- Decant waters will meet RWQCB permit criteria prior to discharge into Battle Creek. Excavated material will be stored using BMPs as required by RWQCB permits.

A Spill Prevention and Countermeasure Plan (SPCP) is intended to prevent contamination of soils and waterways from construction and hazardous materials. An SPCP for the project will be developed and implemented. In addition, the project will implement the following measures:

- Soils contaminated with fuels or chemicals will be disposed of in a suitable location to prevent discharge to surface waters.

- Temporary cofferdams will be used to separate construction areas from flowing waters.

- On-site fuels or other hazardous materials will be placed or contained in an area protected from direct runoff.

- If hazardous materials are accidentally released, appropriate State and Federal agencies will be notified immediately.

- Concrete delivery and transfer equipment will be washed in contained areas protected from direct runoff until the material sets.

- Equipment and machinery coming in contact with water will be inspected daily and completely free of grease, oil, petroleum products, or other nonnative materials.

- The SPCP will be developed in coordination with the RWQCB through the section 401 Clean Water Act permitting process.

A Wetland and Riparian Mitigation and Monitoring Plan (WRMMP) is intended to avoid or otherwise, minimize project impacts to wetlands, riparian and upland vegetation, and other ground disturbances, and replace the acreage, function and values of affected habitat. The WRMMP must meet acceptance by the U.S. Army Corps of Engineers before issuance of the section 404 permit for the project. The WRMMP will include measures that:

- provide mitigation such that restored habitats have equal or better function, value, and quality than habitat impacted by implementation of the project;

- avoid shaded riparian aquatic habitat to the maximum extent practical and, replant disturbed areas to provide 100 percent replacement with native woody species;

- integrate concerns for special-status species into the mitigation design to the maximum degree practicable; and,

- design the mitigation such that once established it will require no maintenance.

7. Monitoring

The proposed project will have three monitoring components including: (1) monitoring during project implementation to ensure that conservation measures and BMPs are implemented; (2) post-project adaptive management monitoring to assess how well the project has met the objectives with regard to passage management; and (3) post-project monitoring of site restoration and mitigation including revegetation.

Performance measures associated with structural modifications of the weir and associated ladder at the Coleman NFH will be closely linked to ongoing and new monitoring programs associated with the Battle Creek Restoration project. For example, key anadromous salmonid abundance data for Battle Creek is currently gathered at the upstream fish ladder at the existing barrier weir; USFWS expects this monitoring to continue at the barrier weir site. Similarly, the USFWS Red Bluff office is currently using a weir crest camera at the existing barrier weir to assess undesired escapement above the weir. The Coleman NFH will request that upon construction completion, the USFWS similarly monitor the modified weir crest.

As indicated in Chapter 7 and Table 8-1 of the ASIP, post-project adaptive management monitoring is proposed to evaluate how well the modified barrier weir and fish ladder function. Specifically, USFWS wants to confirm that the modified barrier weir will provide 100 percent blockage of adult salmonids at flows up to 800 cfs, and determine the efficiency of the new fish ladder of passing upstream migrating adult salmonids. The post-project monitoring may involve some tagging of anadromous salmonids (Scott Hamelberg, USFWS, pers. comm., May 26, 2006).

C. Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02) (see Figure 1). For the purposes of this biological opinion, the action area for the proposed project includes the mainstem of Battle Creek, from its confluence at RM 271.5 of the Sacramento River, upstream to the barrier structure of Eagle Canyon Diversion Dam on North Fork Battle Creek, and the barrier structure of Coleman Diversion Dam on South Fork Battle Creek. This area comprises the downstream extent of potential water quality impacts from construction activities, and the upstream extent to which selectively passed migrants may occur, thus affecting spawner abundance and competition in the newly restored reaches of upper Battle Creek.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

The following Federally listed and proposed species (ESUs or DPSs) and designated critical habitat occur in the action area and may be affected by the Coleman NFH Fish Barrier Weir and Ladder Modification project:

Sacramento River winter-run Chinook salmon ESU
endangered (June 28, 2005, 70 FR 37160)

Central Valley spring-run Chinook salmon ESU
threatened (June 28, 2005, 70 FR 37160)

Central Valley spring-run Chinook salmon designated critical habitat
(September 2, 2005, 70 FR 52488)

Central Valley steelhead DPS
threatened (January 5, 2006, 71 FR 834)

Central Valley steelhead designated critical habitat
(September 2, 2005, 70 FR 52488)

A. Species Life History, Population Dynamics, and Likelihood of Survival and Recovery

Pacific salmonids have diversified over time in response to: 1) geographic barriers to gene flow, (2) seasonal and long-term temporal stability, (3) connectivity to other regions permitting faunal interchange, and (4) regional ecologic interaction that sustained complex trophic structure and high diversity (Jacobs *et al.* 2004). Salmon have persisted amid catastrophic and cyclic environmental shifts (volcanic eruptions, tectonic rifts, monsoons, tsunamis, poor ocean productivity, El Nino and La Nina ocean currents, inland drought cycles, flooding, mudslides, *etc*.). Salmon and steelhead are keystone species in freshwater and marine food webs. Their eggs, alevin, and fry are important food items for other fish, birds, and aquatic insects (Willson and Halupka 1995). Adult salmonid returns sustain animal groups in various interconnected food chains, and serve as the primary source of prey for some groups, *e.g.*, bears, eagles, mink, otter, sea lions, and resident killer whale pods. Adult salmon and steelhead carcasses release accumulated nutrients to sustain productivity of riparian and lacustrine ecosystems for the next generation of salmonid juveniles (Willson and Halupka 1995).

1. Sacramento River Winter-Run Chinook Salmon

Sacramento River winter-run Chinook salmon originally were listed as threatened in November 1990 (55 FR 46515). NMFS designated critical habitat for winter-run Chinook salmon on June 16, 1993 (58 FR 33212). Critical habitat was delineated as the Sacramento River from Keswick Dam, RM 302 to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta (Delta), including Kimball Island, Winter Island, and Brown's Island; all waters from Chipps island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of the San Pablo Bay westward of the Carquinez Bridge; and, all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge. The critical habitat designation identifies those physical and biological features of the habitat that are essential to the conservation of the species and that may require special management consideration and protection. Within the Sacramento River this includes the river water, river bottom (including those areas and associated gravel used by winter-run Chinook salmon as spawning substrate), and adjacent riparian zone used by fry and juveniles for rearing. In the areas west of Chipps Island, including San Francisco Bay to the Golden Gate Bridge, this designation includes the estuarine water column and essential foraging habitat and food resources utilized by winter-run Chinook salmon as part of their juvenile outmigration or adult spawning migrations. Winter-run ESU status was reclassified as endangered in January 1994 (59 FR 440) due to continuing decline and increased variability of run sizes since their listing as a threatened species, expected weak returns as a result of two small year classes in 1991 and 1993, and continuing threats to the population. NMFS recognized that the population had dropped nearly 99 percent between 1966 and 1991, and despite conservation measures to improve habitat conditions, the population continued to decline (57 FR 27416). The draft winter-run recovery plan (NMFS 1997) recommended the implementation and continuation of several conservation measures. Since then, the abundance of the winter-run population has increased significantly, prompting NMFS to include the Sacramento River winter-run ESU in the recent review of 27 West Coast salmonid ESUs (69 FR 33102). After its proposal for reclassification of its listed status to "threatened," there were several concerns expressed in public comment over the adequacy and benefits of protective efforts for the winter-run Chinook salmon population to warrant withdrawing the proposal. The Sacramento River winter-run ESU retains its "endangered" listing status (Good *et al.* 2005), as described in the final determinations (70 FR 37160). The ESU includes the naturally spawned population of winter-run Chinook salmon in the Sacramento River, and the hatchery and winter-run captive broodstock components at Livingston Stone NFH.

Historically, winter-run Chinook salmon spawned in the headwaters of the McCloud, Pit, and Little Sacramento Rivers, as well as Hat and Battle Creeks. Construction of Shasta Dam in 1943 and Keswick Dam in 1950 blocked access to all of these waters except Battle Creek, which is blocked annually from August 1 to mid-March, by a weir at the Coleman NFH. The reaches upstream of Coleman NFH are blocked year-round by other small hydroelectric facilities upstream (Moyle *et al.* 1989, NMFS 1997). Most of the current winter-run Chinook salmon spawning and rearing habitat exists between Keswick Dam and Red Bluff Diversion Dam (RBDD) in the Sacramento River.

Juvenile winter-run increase in size and development of osmoregulation ability as they migrate down to the Delta at the confluence of the Sacramento and San Joaquin Rivers. Peak winter-run emigration through the Delta generally occurs from January through April, but the range may extend from September until June (Messersmith 1966; CDFG 1989, 1993; USFWS 1992).

Adult winter-run Chinook salmon enter San Francisco Bay from November through June (Hallock and Fisher 1985) and migrate past RBDD from mid-December through early August (NMFS 1997). The majority of the run passes RBDD from January through May, and peaks in mid-March (Hallock and Fisher 1985). Generally, winter-run Chinook salmon spawn from near Keswick Dam, downstream to RM 243 (Red Bluff, CA). Spawning occurs from late April through mid-August with peak activity between May and June. Eggs and pre-emergent fry require water temperatures at or below 56 ^{o}F for maximum survival during the spawning and incubation period (USFWS 1999). Fry emerge from mid-June through mid-October and move to river margins to rear. Emigration past RBDD begins in mid-July, typically peaks in September, and can continue through March in dry years (Vogel and Marine 1991, NMFS 1997). Winter-run continue to rear in non-natal tributary streams to the Sacramento River during their out-migration. From 1995 to 1999, all winter-run Chinook salmon outmigrating as fry passed RBDD by October, and all outmigrating pre-smolts and smolts passed RBDD by March (Martin *et al.* 2001).

Since 1967, the estimated adult winter-run Chinook salmon population ranged from 186 in 1994 to 117,808 in 1969 (CDFG 2002). The estimate declined from an average of 86,000 adults in 1967-1969 to only 2,000 by 1987-1989, and continued downward to an average 830 fish in 1994-1996. Since then, estimates have increased to an average of 3,136 fish for the period of 1998-2001. Winter-run Chinook salmon abundance estimates and cohort replacement rates since 1986 are shown in Table 1.

Although the population estimates display broad fluctuation since 1986 (*i.e.*, from 2,596 in 1986 to 186 in 1994 to 15,730 in 2005), there is an increasing trend in the 5-year moving average since 1997 (*e.g.*, from 491 for 1990-1994 to 9,463 for 2001-2005). The 5-year moving average of CRRs has fluctuated up and down (*e.g.*, the 1994, 1997 and 2000 cohorts represent 4.73, 1.54, and 6.08 CRRs). The CRR for cohort 2001 is less than half of the CRR of the 1998 generation (0.94 verses 2.74).

Recent trends in winter-run Chinook salmon abundance and cohort replacement remain positive, indicating some recovery since the listing. However, the population remains well below the recovery goals of the draft recovery plan, and is particularly susceptible to extinction because of the reduction of the genetic pool to one population.

Table 1. Winter-run Chinook salmon population estimates from RBDD counts, and corresponding cohort replacement rates (CRR) for years since 1986.

Year	Population Estimate	5 Year Moving Average of Population Estimate	Cohort Replacement Rate	5 Year Moving Average of Cohort Replacement Rate
1986	2596	-	0.27	-
1987	2186	-	0.20	-
1988	2885	-	0.07	-
1989	696	-	1.78	-
1990	430	1759	0.90	0.64
1991	211	1282	0.88	0.77
1992	1240	1092	1.05	0.94
1993	387	593	3.45	1.61
1994	186	491	4.73	2.20
1995	1297	664	2.31	2.48
1996	1337	889	2.46	2.80
1997	880	817	1.54	2.90
1998	3002	1340	2.74	2.76
1999	3288	1961	2.26	2.22
2000	1352	1972	6.08	3.02
2001	8224	3349	0.94	2.71
2002	7441	4661	2.11	2.64
2003	8218	5705	-	-
2004	7701	6587	-	-
2005	15730	9463	-	-

Viable Salmonid Population Summary

Abundance. Redd and carcass surveys, and fish counts suggest that the abundance of winter-run Chinook salmon is increasing. Population growth is estimated to be positive in the short-term trend at 0.26; however, the long-term trend is negative, averaging -0.14. Recent winter-run Chinook salmon abundance represents only 3 percent of the maximum post-1967, 5-year geometric mean, and is not yet well established (NMFS 2003).

Productivity. ESU productivity has been positive over the short term, and adult escapement and juvenile production have been increasing annually (NMFS 2003). The long-term trend for the ESU remains negative, as it consists of only one population that is subject to possible impacts from environmental and artificial conditions. The most recent CRR estimate suggests a reduction in productivity for the 1998-2001 cohort.

Spatial Structure. The greatest risk factor for winter-run Chinook salmon lies with their spatial structure (NMFS 2003). The remnant population cannot access historical winter-run habitat and must be artificially maintained in the Sacramento River by a regulated cold water pool from Shasta Dam. Winter-run Chinook salmon require cold water temperatures in summer that simulate their upper basin habitat, and they are more likely to be exposed to the impacts of drought in a lower basin environment. Battle Creek remains the most feasible opportunity for the ESU to expand its spatial structure, which currently is limited to the upper 25-mile reach below Shasta Dam.

Diversity. The second highest risk factor for the Sacramento River winter-run Chinook salmon ESU has been the detrimental effects on its diversity. The present winter-run population has resulted from the introgression of several stocks that occurred when Shasta Dam blocked access to the upper watershed. A second genetic bottleneck occurred with the construction of Keswick Dam; there may have been several others within the recent past (NMFS 2003).

2. <u>Central Valley Spring-Run Chinook Salmon and Critical Habitat</u>

NMFS listed the Central Valley spring-run Chinook salmon ESU as threatened on September 16, 1999 (64 FR 50394), and published a final 4(d) rule for this ESU on January 9, 2002 (67 FR 1116). NMFS proposed that the Central Valley spring-run ESU retain its listing status in the recent status review of West Coast Pacific salmonid ESUs (69 FR 33102), which was finalized in June 2005 (70 FR 37160). A final rule designating critical habitat was published on September 2, 2005 (70 FR 52488). Critical habitat was designated for watersheds along the Sacramento-San Joaquin corridor, in the following counties: Tehama, Butte, Glenn, Shasta, Yolo, Sacramento, Solano, Colusa, Yuba, Sutter, Trinity, Alameda, San Joaquin, and Contra Costa. Critical habitat includes the stream channels within the designated stream reaches, and their lateral extent as defined by the ordinary high-water line (33 CFR 329.11) or the full bank elevation. Critical habitat in estuarine reaches is defined by the perimeter of the water body or the elevation of the extreme high water mark, whichever is greater. The primary constituent elements (PCEs) of critical habitat essential for the conservation of the ESU are considered those sites and habitat components that support one or more life stages, including: freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and estuarine areas with appropriate water quality and quantity, floodplain connectivity, forage base, natural cover, and complexity.

The Central Valley spring-run Chinook salmon ESU includes all naturally spawned populations of spring-run Chinook salmon (and their progeny) in the Central Valley. The Feather River Hatchery (FRH) spring-run Chinook salmon population has been included as part of the Central Valley spring-run Chinook salmon ESU as of June 28, 2005 (70 FR 37160). Extant spring-run populations in the southern Cascades ecoregion include those in Mill, Deer and Butte Creeks (NMFS 2003). Spring-run populations of the northern Sierra ecoregion are found in the Yuba and Feather Rivers.

Historically, spring-run Chinook salmon were the dominant run in the Sacramento River basin, occupying the middle and upper elevation reaches (1,000 to 6,000 feet) of most streams and rivers with sufficient habitat for over-summering adults (Clark 1929). Clark (1929) estimated that there were 6,000 miles of salmon habitat in the Central Valley basin (much of which was high elevation spring-run Chinook salmon habitat) and that by 1928, 80 percent of this habitat had been lost. Yoshiyama *et al.* (1996) determined that, historically, there were approximately 2,000 miles of salmon habitat available prior to dam construction and mining and that only 18 percent of that habitat remains.

Central Valley spring-run Chinook salmon exhibit both ocean-type and stream-type life histories (CDFG 1998). Ocean-type spring-run may begin outmigrating soon after emergence, whereas stream-type spring-run oversummer and emigrate as yearlings with the onset of increased fall storms (CDFG 1998). The emigration period for spring-run Chinook salmon extends from November to early May, with up to 69 percent of young-of-the-year outmigrants passing through the lower Sacramento River between mid-November and early January (Snider and Titus 2000). Outmigrants are also known to rear in non-natal tributaries to the Sacramento River and the Delta (CDFG 1998).

Spring-run Chinook salmon fry and fingerlings can enter the Delta as early as January and as late as June; a cohort's length of residency within the Delta is unknown but probably lessens as the season progresses into the late spring months (CDFG 1998). Shifts in juvenile salmonid abundance demonstrated with various sampling gear reflect discretionary use of the Delta by juvenile salmonids based on their size, age, and degree of smoltification. Chinook salmon spend between 1 and 4 years in the ocean before returning to their natal streams to spawn (Myers *et al.* 1998). Fisher (1994) reported that 87 percent of Chinook trapped and examined at RBDD between 1985 and 1991 were 3-years old.

Adult spring-run Chinook salmon enter the Delta from the Pacific Ocean beginning in January and enter natal streams from March to July. This run timing is well adapted for gaining access to the upper reaches of river systems, 1,500 to 5,200 feet in elevation, prior to the onset of high water temperatures and low flows that would inhibit access to these areas during the fall. In Mill Creek, Van Woert (1964) noted that of 18,290 spring-run Chinook salmon observed from 1953 to 1963, 93.5 percent were counted between April 1 and July 14, and 89.3 percent were counted between April 29 and June 30. During their upstream migration, adult Chinook salmon require streamflows sufficient to provide olfactory and other orientation cues used to locate their natal streams. Adequate streamflows are also necessary to allow adult passage to upstream holding habitat. The preferred temperature range for upstream migration is 38 EF to 56 EF (Bell 1991, CDFG 1998).

Upon entering fresh water, spring-run Chinook salmon are sexually immature and must hold in cold water for several months to mature. Typically, spring-run Chinook salmon utilize mid- to high-elevation streams that provide appropriate temperatures and sufficient flow, cover, and pool depth to allow over-summering. Spring-run Chinook salmon may also utilize tailwaters below dams if cold water releases provide suitable habitat conditions. Chinook salmon are semelparous, *i.e.*, they breed only once in their life history. Spawning occurs between September and October and, depending on water temperature, emergence occurs between November and February.

Spring-run Chinook salmon were once the most abundant run of salmon in the Central Valley (Campbell and Moyle 1992), and were found in both the Sacramento and San Joaquin drainages. More than 500,000 spring-run Chinook salmon were caught in the Sacramento-San Joaquin commercial fishery in 1883 alone (Yoshiyama *et al.* 1998). The San Joaquin populations essentially were extirpated by the 1940s, with only small remnants of the run that persisted through the 1950s in the Merced River (Hallock and Van Woert 1959, Yoshiyama *et al.* 1998). Populations in the upper Sacramento, Feather, and Yuba Rivers were eliminated with the construction of major dams during the1950s and 1960s. Naturally-spawning populations of spring-run Chinook salmon currently are restricted to accessible reaches of the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Mill Creek, Feather River, and the Yuba River (CDFG 1998).

Since 1969, the Central Valley spring-run Chinook salmon ESU has displayed broad fluctuations in abundance, ranging from 1,403 in 1993 to 25,890 in 1982 (CDFG, unpublished data, 2003). The average abundance for the ESU was 12,590 for the period of 1969 to 1979, 13,334 for the period of 1980 to 1990, and 6,554 from 1991 to 2001. Evaluating the abundance of the ESU as a whole, however, complicates trend detection. For example, although the mainstem Sacramento River population appears to have undergone a significant decline, the data are not necessarily comparable because coded wire tag information gathered from fall-run Chinook salmon returns since the early 1990s has resulted in adjustments to ladder counts at RBDD that have reduced the overall number of fish that are categorized as spring-run Chinook salmon (Colleen Harvey-Arrison, CDFG, pers. comm.).

Sacramento River tributary populations in Mill, Deer, and Butte Creeks are probably the best trend indicators for spring-run Chinook salmon abundance. These streams have shown positive escapement trends since 1991, yet recent escapements to Butte Creek, including 20,259 in 1998, 9,605 in 2001 and 8,785 in 2002, are responsible for the magnitude of tributary abundance (CDFG unpublished data 2002, 2003). The Butte Creek estimates, which account for the majority of this ESU, do not include pre-spawning mortality. In the last several years as the Butte Creek population has increased, mortality of adult spawner has increased from 21 percent in 2002 to 60 percent in 2003 due to over-crowding and diseases associated with high water temperatures. This trend may indicate that the population in Butte Creek may have reached its carrying capacity (Ward *et al.* 2003) or has reached historical population levels (*i.e*., Deer and Mill creeks). Table 5 shows the population trends from the three tributaries since 1986, including the 5-year moving average, CRR, and estimated juvenile production (JPE). Although recent tributary production is promising, annual abundance estimates display a high level of fluctuation and the overall number of Central Valley spring-run Chinook salmon remains well below estimates of historic abundance.

The extent of spring-run Chinook salmon spawning in the mainstem of the upper Sacramento River is unclear. Very few spring-run Chinook salmon redds (less than 15 per year) were observed from 1989-1993, and none in 1994, during aerial redd counts (USFWS 2003). Recently, the number of redds in September has varied from 29 to 105 during 2001 though 2003 depending on the number of survey flights (CDFG, unpublished data). In 2002, based on RBDD

Table 2. Spring-run Chinook salmon population estimates from CDFG Grand Tab (February 2005) with corresponding cohort replacement rates for years since 1986.

Year	Deer/Mill/Butte Creek	5-Year Moving Average of	Cohort Replace	5-Year Moving	NMFS Calculated

	Escapement Run Size	Population Estimate	ment Rate	Average Cohort Replacement Rate	JPE[a]
1986	24,263	-	-	-	4,396,998
1987	12,675	-	-	-	2,296,993
1988	12,100	-	-	-	2,192,790
1989	7,085	-	0.29	-	1,283,960
1990	5,790	12,383	0.46	-	1,049,277
1991	1,623	7,855	0.13	-	294,124
1992	1,547	5,629	0.22	-	280,351
1993	1,403	3,490	0.24	0.27	254,255
1994	2,546	2,582	1.57	0.52	461,392
1995	9,824	3,389	6.35	1.70	1,780,328
1996	2,701	3,604	1.93	2.06	489,482
1997	1,431	3,581	0.56	2.13	259,329
1998	24,725	8,245	2.52	2.58	4,480,722
1999	6,069	8,950	2.25	2.72	1,099,838
2000	5,457	8,077	3.81	2.21	988,930
2001	13,326	10,202	0.54	1.94	2,414,969
2002	13,218	12,559	2.18	2.26	2,395,397
2003	8,902	9,394	1.63	2.08	1,613,241
2004	9,872	10,155	0.74	1.78	1,789,027
median	7,085	8,077	1.15	2.07	1,283,960

[a]NMFS calculated the spring-run JPE using returning adult escapement numbers to Mill, Deer, and Butte Creeks for the period between 1986 and 2004, and assuming a female-to-male ratio of 3:2 and pre-spawning mortality of 25 percent. NMFS utilized the female fecundity values in Fisher (1994) for spring-run Chinook salmon (4,900 eggs/female). The remaining survival estimates used the winter-run values for calculating JPE.

ladder counts, 485 spring-run Chinook salmon adults may have spawned in the mainstem Sacramento River or entered upstream tributaries such as Clear or Battle Creek (CDFG 2004). In 2003, no adult spring-run Chinook salmon were believed to have spawned in the mainstem Sacramento River. Due to geographic overlap of ESUs and resultant hybridization since the construction of Shasta Dam, Chinook salmon that spawn in the mainstem Sacramento River during September are more likely to be identified as early fall-run rather than spring-run Chinook salmon.

The initial factors that led to the decline of Central Valley spring-run Chinook salmon were related to the loss of upstream habitat behind impassible dams. Since this initial loss of habitat, other factors have contributed to the decline of Central Valley spring-run Chinook salmon and affected the ESU's ability to recover. These include a combination of physical, biological, and management factors such as climatic variation, water management, hybridization, predation, and harvest (CDFG 1998). Although protective measures likely have led to recent increases in Central Valley spring-run Chinook salmon abundance, the ESU still is below levels observed from the 1960s through 1990. Because threats to the spring-run Chinook salmon ESU continue to persist, and because the ESU is confined to relatively few remaining streams and continues to display broad fluctuations in abundance, the population is at moderate risk of extinction.

Viable Salmonid Population Summary

Abundance. The Central Valley spring-run Chinook salmon ESU has experienced a trend of increasing abundance in some natural populations, most dramatically in the Butte Creek population (NMFS 2003). There has been more opportunistic utilization of migration-dependent streams overall. The FRH spring-run stock has been included in the ESU based on its genetic linkage to the natural population and the potential development of a conservation strategy for the hatchery program.

Productivity. The 5-year geometric mean for the extant Butte, Deer, and Mill Creek spring-run populations ranges from 491 to 4,513 fish (NMFS 2003), indicating increasing productivity over the short-term and projected as likely to continue (NMFS 2003). The productivity of the Feather River and Yuba River populations and contribution to the Central Valley spring-run ESU currently is unknown.

Spatial Structure. Spring-run Chinook salmon presence has been reported more frequently in several upper Central Valley creeks, but the sustainability of these runs is unknown. Butte Creek spring-run cohorts have recently utilized all available habitat in the creek; the population cannot expand further and it is unknown if individuals have opportunistically migrated to other systems. The spatial structure of the spring-run ESU has been reduced with the extirpation of all San Joaquin River basin spring-run populations.

Diversity. The Central Valley spring-run ESU is comprised of two genetic complexes. Analysis of natural and hatchery spring-run Chinook salmon stocks in the Central Valley indicates that the southern Cascades spring-run population complex (Mill, Deer, and Butte creeks) retains genetic integrity. The genetic integrity of the Sierra Nevada spring-run complex populations has been compromised. The Feather River spring-run have introgressed with fall-run, and it appears that the Yuba River population has been impacted by FRH fish straying into the Yuba River. The diversity of the spring-run ESU has been further reduced with the loss of the San Joaquin River basin spring-run populations.

3. Central Valley Steelhead and Critical Habitat

NMFS listed the Central Valley steelhead DPS as threatened on March 19, 1998 (63 FR 13347), and published a final 4(d) rule for Central Valley steelhead on July 10, 2000 (65 FR 42422). The DPS includes all naturally-produced Central Valley steelhead in the Sacramento-San Joaquin River Basins, excluding steelhead from San Francisco and San Pablo Bays and their tributaries. The Coleman National Fish Hatchery and FRH steelhead populations are now included in the listed population of steelhead (71 FR 834; these populations were previously included in the DPS but were not deemed essential for conservation and thus not part of the listed steelhead population). A final rule designating critical habitat was published on September 2, 2005 (70 FR 52488). Central Valley steelhead critical habitat was designated for watersheds along the Sacramento-San Joaquin corridor, including the following counties: Tehama, Butte, Glenn, Shasta, Yolo, Sacramento, Solano, Yuba, Sutter, Placer, Calaveras, San Joaquin, Stanislaus, Tuolumne, Merced, Alameda, and Contra Costa. Critical habitat includes the stream channels within the designated stream reaches, and their lateral extent as defined by the ordinary high-water line (33 CFR 329.11) or the full bank elevation. Critical habitat in estuarine reaches is defined by the perimeter of the water body or the elevation of the extreme high water mark, whichever is greater. The PCEs of critical habitat essential for the conservation of the ESU are considered those sites and habitat components that support one or more life stages, including: freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and estuarine areas with appropriate water quality and quantity, floodplain connectivity, forage base, natural cover, and complexity.

All steelhead stocks in the Central Valley are thought to be winter-run steelhead (McEwan and Jackson 1996). Steelhead are similar to Pacific salmon in their life history requirements. They are propagated in freshwater, emigrate to the ocean, and return to freshwater to spawn. Unlike other Pacific salmon, steelhead are iteroparous, *i.e.*, capable of spawning more than once before they die.

The majority of the Central Valley steelhead spawning migration occurs from October through February, and spawning occurs from December to April in streams with cool, well oxygenated water that is available year-round. Van Woert (1964) and Harvey (1995) observed that in Mill Creek, the steelhead migration is continuous, and although there are two peak periods, 60 percent of the run is passed by December 30. Similar bimodal run patterns have also been observed in the Feather River (Ryan Kurth, DWR, pers. comm.), and the American River (John Hannon, Reclamation, pers. comm.), indicating the important of mainstem tributaries as rearing and refugia habitat for the DPS.

Egg incubation time is dependent upon water temperature. Eggs held between 50 ^{o}F and 59 ^{o}F hatch within 3 to 4 weeks (Moyle 1976). Fry usually emerge from redds after about 4 to 6 weeks depending on redd depth, gravel size, siltation, and water temperature (Shapovalov and Taft 1954). Newly emerged fry move to shallow stream margins to escape high water velocities and predation (Barnhart 1986). As fry grow larger, they move into riffles and pools, and establish feeding locations. Juveniles rear in freshwater for 1 to 4 years (Meehan and Bjornn 1991) emigrating episodically from natal springs during fall, winter, and spring high flows (Colleen Harvey-Arrison, CDFG, pers. comm.). Steelhead typically spend 2 years in freshwater. Adults spend 1 to 4 years at sea before returning to freshwater to spawn as four- or five-year-olds (Moyle 1976).

Hallock *et al.* (1961) found that juvenile steelhead in the Sacramento River basin migrated downstream during most months of the year, but the peak period of emigration occurred in the spring, with a much smaller peak in the fall. Steelhead smolts show up at the Tracy and Banks pumping plants between December and June. Adult steelhead migrate upstream in the Sacramento River mainstem from July through March, with peaks in September and February (Bailey 1954, Hallock *et al.* 1961). The timing of upstream migration is generally correlated with higher flow events, such as freshets or sand bar breaches, and associated lower water temperatures.

Steelhead historically were well-distributed throughout the Sacramento and San Joaquin Rivers (Busby *et al.* 1996). Steelhead were found from the upper Sacramento and Pit River systems, south to the Kings and possibly the Kern River systems, and in both east- and west-side Sacramento River tributaries (Yoshiyama *et al.* 1996). The present distribution has been greatly reduced (McEwan and Jackson 1996). The California Advisory Committee on Salmon and Steelhead (1988) reported a reduction of steelhead habitat from 6,000 miles historically to 300 miles. The California Fish and Wildlife Plan (CDFG 1965) estimated there were 40,000 steelhead in the early 1950s. Hallock *et al.* (1961) estimated an average of 20,540 adult steelhead through the 1960s in the Sacramento River, upstream of the Feather River.

Historically, steelhead probably ascended Clear Creek past the French Gulch area, but access to the upper basin was blocked by Whiskeytown Dam in 1964 (Yoshiyama *et al.* 1996). Existing wild steelhead stocks in the Central Valley are confined mostly to the upper Sacramento River and its tributaries, including Antelope, Deer, and Mill Creeks, and the Yuba River. Populations may exist in Big Chico and Butte Creeks, and a few wild steelhead are produced in the American and Feather Rivers (McEwan and Jackson 1996). Until recently, steelhead were thought to be extirpated from the San Joaquin River system. Recent monitoring has detected self-sustaining populations of steelhead in the Stanislaus, Mokelumne, Calaveras, and other streams previously thought to be void of steelhead (McEwan 2001). It is possible that naturally-spawning populations exist in many other streams but are undetected due to lack of monitoring programs (Interagency Ecological Program (IEP) Steelhead Project Work Team 1999).

Reliable estimates of steelhead abundance for different basins are not available (McEwan 2001), monitoring of steelhead populations in the Sacramento River and its tributaries is limited to the direct counts made at Coleman NFH weir and at RBDD, FRH, and Nimbus Hatchery. McEwan and Jackson (1996) estimate the total annual run size for the entire Sacramento-San Joaquin system, based on RBDD counts, to be no more than 10,000 adults. Steelhead counts at the RBDD have declined from an average of 11,187 for the period of 1967 to 1977, to an average of approximately 2,000 through the 1990s (McEwan and Jackson 1996, McEwan 2001). Trawling data collected in the Sacramento River and at Chipps Island indicate that the vast majority of out-migrating juvenile steelhead are of hatchery origin, with juvenile numbers having decreased overall from the 2001-2002 juvenile estimates.

Nobriga and Cadrett (2003) compared coded-wire tagged (CWT) and untagged (wild) steelhead smolt catch ratios at Chipps Island trawl from 1998-2001 to estimate that about 100,000 to 300,000 steelhead juveniles are produced naturally each year in the Central Valley. In the draft *Updated Status Review of West Coast Salmon and Steelhead* (NMFS 2003), the NMFS made the following conclusion based on the Chipps Island data:

> "If we make the fairly generous assumptions (in the sense of generating large estimates of spawners) that average fecundity is 5,000 eggs per female, 1 percent of eggs survive to reach Chipps Island, and 181,000 smolts are produced (the 1998-2000 average), about 3,628 female steelhead spawn naturally in the entire Central Valley. This can be compared with McEwan's (2001) estimate of 1 million to 2 million spawners before 1850, and 40,000 spawners in the 1960s".

Recent snorkel surveys (1999 to 2002) indicate that steelhead are present in Clear Creek (J. Newton, USFWS, pers. comm. 2002, as reported in NMFS 2003). Because of the large resident *O. mykiss* population in Clear Creek, steelhead spawner abundance has not been estimated.

On the Stanislaus River, steelhead smolts have been captured in rotary screw traps at Caswell State Park and Oakdale each year since 1995 (Demko *et al.* 2000). After 3 years of operating a fish counting weir on the Stanislaus River only one adult steelhead has been observed moving upstream, although several large rainbow trout have washed up on the weir in late winter (S.P. Cramer 2005). It is possible that naturally spawning populations exist in many other streams but are undetected due to lack of monitoring programs (IEP Steelhead Project Work Team 1999).

The only consistent data available on steelhead numbers in the San Joaquin River basin come from CDFG mid-water trawling samples collected on the lower San Joaquin River at Mossdale. These data (see Figure 8) indicate a decline in steelhead numbers in the early 1990s, which have remained low through 2002 (CDFG 2003). In 2003, a total of 12 steelhead smolts were collected at Mossdale (CDFG, unpublished data).

Both the Biological Review Team (NMFS 2003) and the Artificial Propagation Evaluation Workshop (69 FR 33102) concluded that the Central Valley steelhead DPS presently are "in danger of extinction." However, in the proposed status review NMFS concluded that the DPS in-total is "not in danger of extinction, but is likely to become endangered within the foreseeable future" citing unknown benefits of restoration efforts and a yet-to-be-funded monitoring program (69 FR 33102). Steelhead already have been extirpated from most of their historical range in this region. Habitat concerns in this DPS focus on the widespread degradation, destruction, and blockage of freshwater habitat within the region, and water allocation problems. Hatchery steelhead production within this DPS also raises concerns about the potential ecological interactions between introduced stocks and native stocks. Because the Central Valley steelhead population has been fragmented into smaller isolated tributaries without any large source population and the remaining habitat continues to be degraded by water diversions, the population is at high risk of extinction.

The factors affecting the survival and recovery of Central Valley steelhead are similar to those affecting Central Valley spring-run Chinook salmon and primarily are associated with habitat loss (McEwan 2001). The future of Central Valley steelhead is uncertain because limited data concerning their status. Central Valley steelhead populations generally show a continuing decline, an overall low abundance, and fluctuating return rates (NMFS 2003).

<u>Viable Salmonid Population Summary</u>

Abundance. All indications are that naturally spawned Central Valley steelhead have continued to decrease in abundance and in the proportion of the steelhead population compared to hatchery fish over the past 25 years (NMFS 2003); the long-term trend remains negative. There has been little steelhead population monitoring despite 100 percent marking of hatchery steelhead since

1998. Hatchery production and returns are dominant over natural fish and include significant numbers of out-of-basin, non-DPS-origin steelhead stocks.

Productivity. An estimated 100,000 to 300,000 natural juvenile steelhead are estimated to leave the Central Valley annually, based on rough calculations from sporadic catches in trawl gear (NMFS 2003). Concurrently, one million in-DPS hatchery steelhead smolts and another half million out-of-DPS hatchery steelhead smolts are released annually in the Central Valley. The estimated ratio of non-clipped to clipped steelhead has decreased from 0.3 percent to less than 0.1 percent, with a net decrease to one-third of wild female spawners from 1998 to 2000 (NMFS 2003).

Spatial Structure. Steelhead appear to be well-distributed where found throughout the Central Valley (NMFS 2003). Until recently, there was very little documented evidence of steelhead due to the lack of monitoring efforts. Since 2000, steelhead have been confirmed in the Stanislaus and Calaveras Rivers.

Diversity. Analysis of natural-and hatchery-steelhead stocks in the Central Valley reveal genetic structure remaining in the ESU (Nielsen *et al.* 2003). There appears to be a great amount of gene flow among upper Sacramento River basin stocks, due to the post-dam, lower basin distribution of steelhead and management of hatchery stocks. Recent reductions in natural population sizes have created genetic bottlenecks in several Central Valley steelhead stocks (NMFS 2003, Nielsen *et al.* 2003). The out-of-basin steelhead stocks of the Nimbus and the Mokelumne River Hatcheries are not included in the Central Valley steelhead DPS.

B. Habitat Condition and Function for Species' Conservation

The freshwater habitat of salmon and steelhead in the Sacramento-San Joaquin drainage varies in function depending on location. Potential spawning areas are located in accessible, upstream reaches of the watersheds within the project area, including Battle Creek and the upper Sacramento River, where viable spawning gravels and water conditions are found. Spawning habitat condition is strongly affected by water flow and quality, especially temperature, dissolved oxygen, and silt load, all of which can greatly affect the survival of eggs and larvae.

Migratory corridors extend from the spawning areas downstream and include the Delta. These corridors allow the upstream passage of adults, and the downstream emigration of juveniles. Migratory habitat condition is strongly affected by the presence of barriers, which can include dams, culverts, flood control structures, unscreened or poorly screened diversions, and degraded water quality.

Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing. Rearing habitat condition and function may be affected by annual and seasonal flow and temperature characteristics. Specifically, the lower reaches of streams often become less suitable for juvenile rearing during the summer. Rearing habitat condition is strongly affected by habitat complexity, food supply, or presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system (*e.g.*, the lower Cosumnes River, Sacramento River reaches with setback levees (primarily located upstream of the City of Colusa) and the flood control bypasses).

Chinook salmon and steelhead are present in the Delta throughout the year as juveniles rear and migrate out to sea, or as adults return to natal streams or sites of hatchery release. Peak occurrence of juvenile salmonids in the Delta varies annually. The start and duration of emigration is dependent upon water year type, precipitation, accretion in the Sacramento River, and water flows. Distinct emigration pulses coincide with high precipitation, increased turbidity, and storm events (Pickard *et al.* 1982). Shifts in juvenile salmonid abundance demonstrated with various sampling gears reflect discretionary use of the Delta by juvenile salmonids based on their size, age, and degree of smoltification.

The San Francisco estuary provides habitat for Chinook salmon fry, parr, and sub-yearlings until their osmoregulatory capability is fully developed (Healey 1991). Fry have been observed in October and November in the estuary, but mainly arrive at the Delta from January to March and reside there for approximately 2 months before migrating seaward (Kjelson *et al.* 1982). Fry are replaced by smolts from upriver in April to mid-June. There is a second, smaller peak in the fall from fish that remain in upstream, cooler water over the summer. Nursery residence time of Chinook salmon fry in the Delta ranged from 64 days in 1980 to 52 days in 1981 (Kjelson *et al.* 1982), reaching approximately 70 mm fork length (FL) before dispersing to nearby estuarine areas.

Fry concentrate near shore in shallow water during the day but tend to move offshore at night, whereas larger fish are further offshore. Fry are concentrated in the upper 3 meters of the water column during the day, becoming randomly distributed in the water column at night (Kjelson *et al.* 1982). Yearling smolts concentrate in the Delta front while fry concentrate in the Delta area, precluding spatial conflict between the two life stages. Some yearlings remain in the estuary and some disperse to nearshore areas adjacent to the river mouth; the length of residence of yearling smolts is relatively brief along sheltered coastal waters in the eastern Pacific Ocean (Healey 1982, MacFarlane and Norton 2001). Spatial separation minimizes opportunity for predation between different life stages of Chinook salmon in the Delta and estuary. Competition for limited food sources within a life stage may occur. Food items important to the diet of young Chinook salmon in the estuary are Insecta and Crustacea, *Neomysis, Corophium, Cladocera, Copepoda,* and *Diptera*.

Kjelson *et al.* (1982) estimated that Chinook salmon rearing in the estuary increased in length by 0.86 mm per day in 1980 and 0.53 mm per day in 1981. MacFarlane and Norton (2001) more recently estimated a 0.18 mm per day increase in FL and 0.02 grams (g) per day increase in weight during a 40-day rearing period in the estuary, with greater daily growth exhibited in ocean habitation. In contrast to other ocean-type races throughout the eastern Pacific Ocean coastline, it does not appear that Central Valley Chinook salmon make extensive use of estuarine habitat (MacFarlane and Norton 2001), although it remains a crucial component in completing their transition to the marine environment. Chinook salmon fry migrate to the estuary in March or April and remain there until June, while Chinook salmon fingerlings arrive in the estuary in

May or June and remain until August or later. Onset of piscivory by larger juvenile Chinook salmon and the oceanic migratory pattern of the stream-type Chinook salmon (spring-run) may contribute to a shorter estuarine residency (Healey 1982).

There is a major difference between ocean-type and stream-type Chinook salmon in oceanic distribution and migratory behavior (Healey 1991). Stream-type Chinook salmon move offshore early in their ocean life, whereas ocean-type Chinook salmon remain in sheltered coastal waters. Stream-type smolts are the first to disperse seaward from the natal estuary after completing their downstream migration (Healey 1991). They are common in surface waters in the spring and early summer, but ocean-type Chinook salmon in their first ocean year are abundant throughout the summer and autumn. Stream-type Chinook salmon comprise no more than 25 percent of all spawning populations from the Sacramento River to southeastern Alaska, but constitute the greater proportion of the high-seas North Pacific population overall regardless of latitude, whereas ocean-type Chinook salmon dominate in coastal waters from southeastern Alaska to California. Juvenile ocean-type Chinook salmon remain close to sheltered waters with some offshore movement. Estuaries offer the only sheltered water habitat along the open Pacific coastline.

In their second and subsequent ocean years, stream-type Chinook salmon from North American have been caught in Asian waters (approximately 177-180^{o} W). Only stream-type Chinook salmon occur in western Alaska and in Asia, and comprise 100 percent of the catches in the western North Pacific Ocean. Ocean-type Chinook salmon appear to dominate in coastal waters from southeastern Alaska to California. Stream-type Chinook salmon contribution to commercial catch has been reduced from historic numbers, likely due to freshwater habitat modification, water diversions, and the inability of older-maturing stream-type Chinook to support a more intensive fishery than younger-maturing ocean-type Chinook salmon (Hankin and Healey 1986). Stream-type Chinook salmon from California are known to range to southern Canadian waters, but some range further as indicated by a tagged fish from a California stock incidentally caught within the fishery conservation zone (*a.k.a.*, the 200-mile Exclusive Economic Zone) of Alaska (Healey 1991).

There appears to be a predominant northward dispersal of juveniles along the coast, and a southward homing migration of maturing adults. Age-specific mortality decreases over time in Chinook salmon and most ocean mortality occurs during the first 2 years of ocean life (Cramer 2002). Hankin and Healey (1986) found that maturing Chinook salmon returning to their native river may travel more than 45 kilometers per day (km)/d or close to their optimal cruising speed, on a direct course toward the river. They remain in the river estuaries for some time and can be vulnerable to gillnet fisheries.

C. Factors Affecting the Species and Habitat

Profound alterations to the riverine habitat of the Central Valley began with the discovery of gold in the mid-1800s which resulted in increased sedimentation, which reduced spawning and rearing habitat quality from mining activities and land uses. Other human activities have contributed to the decline in Central Valley anadromous salmonids and their habitats, eventually leading to listing the species under the ESA. These activities are ongoing and continue to affect the species, and include: (1) dam construction and continued use that blocks previously accessible spawning and rearing habitat; (2) water development activities that affect flow quantity, timing, and water quality; (3) land use activities such as agriculture, flood control, urban development, mining, and logging that degrade aquatic habitat and decrease prey abundance; (4) hatchery operation and practices; and (5) harvest activities.

Hydropower, flood control, and water supply dams of the Central Valley Project (CVP), the State Water Project (SWP), and other municipal and private entities have permanently blocked or hindered salmonid access to historical spawning and rearing grounds. Large dams on every major tributary to the Sacramento and San Joaquin Rivers block Chinook salmon and steelhead access to the upper portions of the respective watersheds. On the Sacramento River, Keswick and Shasta Dams block passage to historic spawning and rearing habitat in the upper Sacramento, McCloud, and Pit Rivers. On the Feather River, Oroville Dam and associated facilities block passage to the upper Feather River watershed. Nimbus Dam blocks access to most of the American River basin. Englebright Dam and Daguerre Point Dam block access to the upper Yuba River. The upper watersheds of these basins comprised preferred spawning and rearing habitat for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead.

Depleted flows in dammed waterways have contributed to elevated temperatures, reduced dissolved oxygen levels, and decreased recruitment of gravel, large woody debris, and riparian vegetation (Spence *et al.* 1996). Historical seasonal flow patterns included high flood flows in the winter and spring with declining flows throughout the summer and early fall. With the completion of upstream reservoir storage projects throughout the Central Valley, the seasonal distribution of flows differs substantially from historical patterns. The magnitude and duration of peak flows during the winter and spring are reduced by water impoundment in upstream reservoirs. Instream flows during the summer and early-fall months have increased over historic levels for deliveries of municipal and agricultural water supplies (CALFED 2000). Warm water releases from Shasta Dam have negatively affected winter-run Chinook salmon spawning success in particular. Water management now reduces natural variability by creating more uniform flows year-round that diminish natural channel forming, riparian vegetation, and food web functions.

Water diversions for irrigated agriculture, municipal and industrial use, and managed wetlands, are found throughout the Central Valley. Hundreds of water diversions exist along the Sacramento River and its tributaries. Depending on the size, location, and season of operation, unscreened intakes may entrain many life stages of aquatic species, including juvenile salmonids.

About 150 years ago, the Sacramento River was bordered by up to 500,000 acres of riparian forest, with bands of vegetation literally spreading 4 to 5 miles (Resources Agency, State of California 1989). By 1979, riparian habitat along the Sacramento River diminished to 11,000-12,000 acres or about 2 percent of historic levels (McGill 1979). More recently, about 16,000 acres of remaining riparian vegetation has been reported (McGill 1987). Degradation and fragmentation of riparian habitat has resulted mainly from flood control and bank protection projects, together with the conversion of riparian land to agriculture (Jones and Stokes Associates 1993).

Increased sedimentation resulting from agricultural and urban practices within the Central Valley is another cause of salmonid habitat degradation. Sedimentation can adversely affect salmonids during all freshwater life stages by clogging or abrading gill surfaces; adhering to eggs, inducing behavioral modifications including habitat avoidance or cessation of feeding, burying eggs or alevins, scouring and filling pools and riffles, reducing primary productivity and photosynthetic activity, decreasing intergravel permeability, and decreasing dissolved oxygen levels. Embedded substrates can reduce the production of juvenile salmonids and hinder the ability of some over-wintering juveniles to hide in the gravels during high flow events. The flow regimes, sediment budgets, and channel dynamics of tributaries to the Sacramento and San Joaquin Rivers have been altered since 1850 to great extent. Reservoir storage is equivalent to about 80 percent of mean annual runoff in the Sacramento River basin, and about 135 percent in the San Joaquin (Kondolf 2000). Reduction of winter floods has reduced sediment transport capacity and channel dynamics to 17 percent of original transport capacity.

Salmon have historically played a role in providing marine-derived nutrients to watersheds (Gresh *et al.* 2000). The death and decay of salmon after spawning results in the release of nutrients. The dramatic decline of salmon runs has decreased nitrogen and phosphorus input into watersheds from historical levels in the majority of river basins.

Land use activities associated with road construction, urban development, logging, mining, agriculture, and recreation have significantly altered fish habitat quantity and quality through alteration of streambank and channel morphology, alteration of ambient stream water temperatures, degradation of water quality, elimination of spawning and rearing habitat, fragmentation of available habitats, elimination of downstream recruitment of gravel and large woody debris, removal of riparian vegetation and elimination of large trees, and increased streambank erosion. Large woody debris influences stream morphology by affecting pool formation, channel pattern and position, and channel geometry. Organic input to the water course also provides nutrients necessary for primary productivity and as a food source for aquatic insects, which are in turn are consumed by salmonids.

Hatchery practices as well as spatial and temporal overlaps of habitat use and spawning activity between spring- and fall-run Chinook salmon has led to the hybridization and homogenization of some subpopulations (CDFG 1998). As early as the 1960s, Slater (1963) observed that early fall-run fish were competing with spring-run Chinook salmon for spawning sites in the Sacramento River below Keswick Dam and speculated that the two runs may had hybridized. FRH spring-run Chinook salmon have been documented as straying throughout Central Valley streams for many years (CDFG 1998), and in many cases have been recovered from the spawning grounds of fall-run Chinook salmon (Colleen Harvey-Arrison and Paul Ward, CDFG, pers. comm.). This indicates that the FRH spring-run Chinook salmon may exhibit fall-run life-history characteristics. Although the degree of hybridization has not been comprehensively determined, it is clear that the populations of spring-run Chinook salmon spawning in the Feather River and counted at RBDD contain hybridized fish.

Accelerated predation may also be a factor in the decline of Chinook salmon and steelhead in the Central Valley. Although predation is a natural component of salmonid ecology, the rate of predation on Central Valley salmonids likely has greatly increased through the introduction of non-native predatory species such as striped bass and largemouth bass, and through the alteration of natural flow regimes and the development of structures that attract predators, including dams, bank revetment, bridges, diversions, piers, and wharfs (Stevens 1961, Decato 1978, Vogel *et al.* 1988, Garcia 1989). U.S. Fish and Wildlife Service staff found that more predatory fish occurred at rock revetment bank protection sites between Chico Landing and Red Bluff than at sites with naturally-eroding banks (Michny and Hampton 1984). On the mainstem Sacramento River, high rates of predation are known to occur at RBDD, the Anderson-Cottonwood Irrigation District (ACID) diversion, the Glenn-Colusa Irrigation District diversion, and at south Delta water diversion structures (CDFG 1998). From October 1976 to November 1993, CDFG conducted 10 mark/recapture experiments at the SWP's Clifton Court Forebay to estimate pre-screen losses using hatchery-reared juvenile Chinook salmon. Pre-screen losses ranged from 69 percent to 99 percent. Predation from striped bass is thought to be the primary cause of the loss (Gingras 1997, CDFG 1998).

Threats to the Delta ecosystem (USFWS 1996) include: (1) loss of habitat from increased freshwater exports; (2) increased salinity, dredging, diking and filling; (3) introduced aquatic species that have disrupted the food chain; (4) programs which employ chemical controls to contain exotic vegetation; and, (5) entrainment (movement of fish by currents) in Federal, State, and private water diversions (USFWS 1996). Channelized, leveed, and rip-rapped river reaches and sloughs that are common in the Delta typically have low habitat complexity, low abundance of food organisms, and offer little protection from either fish or avian predators. Changed pattern and timing of flows through the Delta, sport and commercial harvest, and interactions with hatchery stocks have all affected salmon and steelhead runs entering the Delta (USFWS 1996).

Chinook salmon are harvested in ocean commercial, ocean recreational, and inland recreational fisheries. CWT returns indicate that Sacramento River salmon congregate off the coast between Point Arena and Morro Bay. Ocean fisheries have affected the age structure of spring-run Chinook salmon through targeting large fish for many years and reducing the number of 4 and 5 year olds (CDFG 1998). An analysis of six tagged groups of FRH spring-run Chinook salmon by Cramer and Demko (1997) indicated that harvest rates of 3-year-old fish ranged from 18 percent to 22 percent, 4-year-olds ranged from 57 percent to 84 percent, and 5-year-olds ranged from 97 percent to 100 percent. Reducing the age structure of the species reduces its resiliency to factors that may impact a year class. In-river recreational fisheries historically have taken fish throughout the species' range. During the summer, holding adult spring-run Chinook salmon are easily targeted by anglers when they congregate in large pools. Poaching also occurs at fish ladders, and other areas where adults congregate, but the significance of poaching on the adult population is unknown.

Several actions have been taken to improve habitat conditions for Central Valley salmonids. The impetus for initiating restoration actions stem primarily from ESA temperature, flow, and diversion requirements (*e.g.*, NMFS biological opinion addressing the effects of Reclamation's operation of the CVP and DWR's operation of the SWP on winter-run Chinook salmon (NMFS 1993)); State Water Resources Control Board (SWRCB) orders requiring compliance with Sacramento River water temperature objectives; a 1992 amendment to the authority of the CVP through the CVPIA to give fish and wildlife equal priority with other CVP objectives (*e.g.*, in section 3406(b)(2), establishment of a water account to supplement CVPIA minimum flow requirements); fiscal support of habitat improvement projects from CALFED (*e.g.*, installation of the Glenn-Colusa Irrigation District fish screen, establishment of an Environmental Water Account (EWA), *etc*.); and, U.S. Environmental Protection Agency (EPA) pollution control efforts to alleviate acidic mine drainage from Iron Mountain Mine.

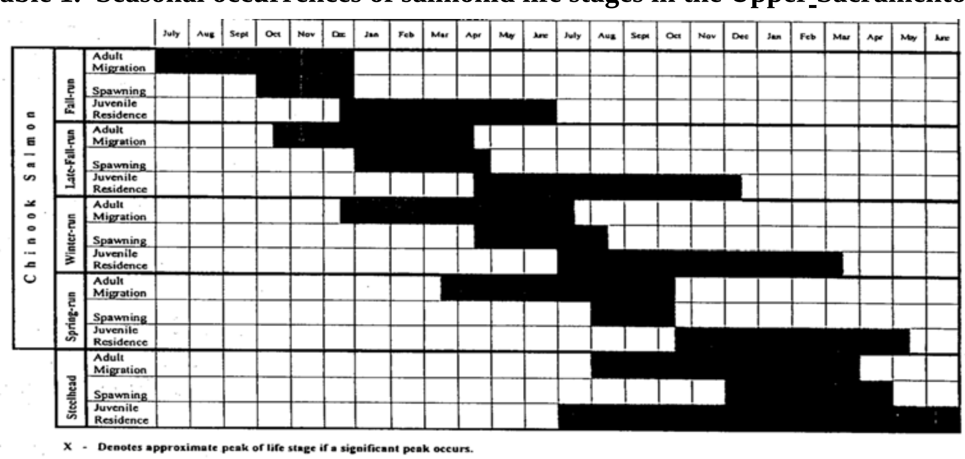
IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species within the action area. The environmental baseline "includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" (50 CFR §402.02).

A. Status of the Species and Habitat within the Action Area

The original salmonid populations of Battle Creek are thought to have been extirpated or drastically reduced by hydropower development in Battle Creek, and further reduced by the construction of the Coleman NFH and barrier weir. The salmon and steelhead now migrating into Battle Creek could be hatchery fish, natural progeny of hatchery fish, strays from the upper Sacramento River basin, or persistent remnants of the natural Battle Creek populations (Harza 2001).

Table 1. Seasonal occurrences of salmonid life stages in the Upper Sacramento River.



Sources: Vogel and Marine (1991) and Schaffer (1980) as reported in Kier Associates (1998).

1. Sacramento River Winter-Run Chinook Salmon

Winter-run Chinook salmon inhabit the upper Sacramento River basin, and opportunistically utilize Sacramento River tributaries and intermittent streams as non-natal rearing habitat, and when conditions are favorable, as spawning habitat (Maslin *et al.* 1996a, b). Historically through recent times, winter-run have been documented in Battle Creek (CDFG 1965; Yoshiyama *et al*. 2000). The presence of winter-run fry in Battle Creek was recorded in 1898 and 1900 (Rutter 1904), and Coleman NFH trapping efforts resulted in over 300 captured winter-run in 1958 (USFWS 1963). A winter-run Chinook salmon conservation hatchery program was initiated at Coleman NFH, following a four-agency cooperative agreement in 1988. Due to imprinting on Battle Creek, the hatchery winter-run did not assimilate into the natural population in the upper Sacramento River basin (USFWS 1996). To remediate the situation, operations were moved to the newly constructed Livingston Stone National Fish Hatchery on the upper Sacramento River, in 1998, and hatchery winter-run returns to Battle Creek declined. Most recent monitoring efforts have found only remnant numbers of winter-run in Battle Creek (five adults over years 2000-2005 combined; Reclamation and USFWS 2005).

a. *Sacramento River Winter-Run Chinook Salmon Designated Critical Habitat*

Critical habitat for Sacramento River winter-run Chinook salmon has only been designated within the Sacramento River mainstem and lower estuary areas. Therefore, there is no designated critical habitat within the action area.

2. Central Valley Spring-run Chinook Salmon

The Battle Creek spring-run Chinook salmon population was severely reduced by hydropower development previous to the construction of Coleman NFH. A spring-run Chinook salmon artificial propagation program started in 1943 by Coleman NFH was discontinued in 1951, due to the relative lack of broodstock and high water temperatures. From 1952 to 1956, CDFG estimated 1,700 to 2,200 spring-run Chinook salmon spawning in Battle Creek (CDFG 1961, as cited in Ward and Kier 1999), and stream surveys recorded spring-run presence in Eagle Canyon (1960s-1970s) and South Fork Battle Creek (1970s; CDFG 1966; 1970). Adult escapement may begin in March, peaking in early May. Spawning occurs from mid-August through October, peaking in late September. Spring-run Chinook salmon may pass above Coleman NFH from early March through July 31, when the upstream fish ladder is open. A USFWS survey conducted in 1997 estimated 106 spring-run Chinook salmon returning to Battle Creek between early March and the end of June; spring-run numbers ranging between 34 and 94 fish returned to Battle Creek from 1995 to 2003 (CDFG 2004). Juvenile outmigration peaks between December and February, but continues throughout June through August. Outmigration has averaged approximately 16,000 to 120,000 fish per year, during which an estimated 1,000 spring-run Chinook salmon are expected to outmigrate past the project site from June 1 through September 30.

a. *Central Valley Spring-Run Chinook Salmon Designated Critical Habitat*

Spring-run Chinook salmon critical habitat has been designated in the Battle Creek mainstem, North Fork, and South Fork, based on the stream's high quality holding, spawning and rearing habitat (70 FR 52488). The Battle Creek channel is characterized by alternating pools and riffles. The channel form, along with boulders, ledges, and turbulence, provides key characteristics supporting the PCEs of critical habitat (*i.e.*, freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors).

3. <u>Central Valley Steelhead</u>

A significant portion of the Central Valley steelhead DPS spawns and rears in Battle Creek. Most of the steelhead in Battle Creek likely are of Coleman NFH steelhead stock origin (Cramer *et al.* 1995; USFWS 2001). Both the Battle Creek natural steelhead population and Coleman NFH steelhead stock are part of the threatened Central Valley steelhead DPS, and are protected under the ESA (71 FR 834). Steelhead may be present in August, but the majority of adults enter Battle Creek between September and January. Spawning occurs between late-December and early May. The 10-year average of steelhead in Battle Creek is estimated to number 2,400 fish, of which an average of 42 natural steelhead adults migrate from June through August. The upstream fish ladder is closed August 1, and steelhead enter Coleman NFH once the hatchery ladder is opened, from October 1 through early March.

As part of the Battle Creek Salmon and Steelhead project restoration goal of a natural steelhead run in upper Battle Creek, Coleman NFH bypasses non-clipped steelhead, integrating hatchery operations with restoration efforts. All non-clipped steelhead entering the hatchery are manually bypassed into upper Battle Creek, with the exception of 40 natural steelhead held back for broodstock purposes. During the principal period of steelhead migration in Battle Creek, average monthly flows range from 296 cfs in October to 727 cfs in February, suggesting that some escapement past the weir likely occurs throughout the timing of steelhead migration (Kier and Associates 1999). Juvenile outmigration occurs throughout the year, but occurs to a lesser extent during the summer months, due to high water temperatures. Steelhead juveniles caught by rotary screw trap have provided estimates of 1,410 outmigrants in June, 28 outmigrants in July, and no juveniles in August or September.

a. *Central Valley Steelhead Designated Critical Habitat*

Steelhead critical habitat has been designated in the Battle Creek mainstem, the North and South Forks, and their adjoining tributaries, based on the stream's high quality spawning and rearing habitat (70 FR 52488). As with spring-run Chinook salmon, the channel form of Battle Creek, along with boulders, ledges, and turbulence, provides key characteristics supporting the PCEs of steelhead critical habitat (*i.e.*, freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors).

B. Factors Affecting the Species and Habitat within the Action Area

The essential features of freshwater salmonid habitat within the action area include: adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions. These features have been affected by human activities such as water management, flood control, agriculture, and urban development throughout the action area. Impacts to these features have led to salmonid population declines significant enough to warrant the listing of several salmonid species in the Central Valley of California.

Battle Creek is fed by Lassen Peak in the southern volcanic Cascade Range and numerous springs throughout the year. It is typed as “montane riverine aquatic” habitat in the CALFED MSCS (CALFED 2000a). The creek is approximately 60 miles long, with an entrenched meandering channel with primarily riffle habitat, and encompasses a watershed of 357 square miles above the stream gage near Coleman NFH. Approximately 21 percent of the Battle Creek watershed lies within the Lassen National Forest (LNF). Upper Battle Creek contains remote, deep-shaded gorges similar to streams now blocked by Shasta Dam (U.S. Forest Service 1998). Natural barriers, deep bedrock pools, and cool water springs offer holding and spawning habitat for spring-run Chinook salmon and steelhead in the North Fork Battle Creek. The North Fork is 29.5 miles long and the South Fork is 28 miles long from the headwaters to the confluence with the mainstem of Battle Creek. The overall gradient of Battle Creek is steep, falling over 5,000 feet in less than 50 miles (Reclamation 2003). Battle Creek is an entrenched meandering channel with primarily riffle habitat and a slope of approximately 0.0125 percent. Flows in Battle Creek are less than 500 cfs more than 90 percent of the time, but the stream is "flashy" with winter floods reported to be in excess of 6,000 cfs roughly every other year. Water overflows the banks at 3,000 cfs, which can be expected with two-year intervals. Near its mouth, the creek has average flows of 240 to 260 cfs in summer and fall, and even in drier years, flows are more than 150 cfs (CALFED EIS/EIR 2000). In wettest years, flows in winter months may average 1,200 to 2,400 cfs. Average monthly flow ranges from 255 cfs in September, to 727 cfs in January (USFWS 2001). The north and south forks converge into the main channel of Battle Creek about 9.5 miles from the confluence with the Sacramento River, near the community of Cottonwood.

There is evidence that Battle Creek may have supported all runs of Central Valley salmonids (Yoshiyama *et al.* 1996). Hydropower development in Battle Creek began in 1899. The Volta hydroelectric plant on the north fork Battle Creek was delivering power to Mountain Copper Company’s smelters in the Keswick area in 1901, and was later taken over by PG&E in 1919. The project was licensed by the Federal Power Commission in 1932 and relicensed by the Federal Energy Regulatory Commission (FERC) in 1976, for a period of 50 years.

Silviculture, cattle grazing, fish culture, timber sales, fuel treatments, prescribed burns, fireline construction, road obliteration or construction, culvert placements, tree thinning, tree regeneration, watershed and aquatic restoration, recreation development, and general riparian area management activities dominate upper Battle Creek. Approximately 79 percent of the watershed is in private lands, much of which has been developed for fruit orchards, vineyards, cattle and sheep ranching, and private and state fish enterprises. Development of Battle Creek has resulted in a reduction of salmon and steelhead habitat.

The "properly functioning condition" (PFC) of the Battle Creek basin has been compromised to some extent in its ability to provide rearing habitat for juvenile salmonids, and as a corridor for migrating juvenile and adult salmonids. Carrying capacity and complexity of the habitat has decreased with impacts to SRA habitat (*e.g.*, removal of riverine trees and instream woody material), riprap actions or other modification to the embankment, and water diversion. Spawning habitat capacity in the 17-mile reach above the Coleman NFH weir to the Coleman Diversion Dam can be diminished by low water flows. Spawning success may be reduced by habitat limitations, fish competition, and displacement. Battle Creek has a dependable cold water pool all year, with the potential to increase high-quality salmonid habitat. Its restoration will allow natural processes to increase the ecological function of the habitat, while at the same time removing adverse impacts of current practices. Battle Creek restoration efforts are in process and will assist the recovery of the Sacramento River winter-run and Central Valley spring-run Chinook salmon ESUs and the Central Valley steelhead DPS, by increasing their abundance and spatial structure, and reducing the risk of extinction (USFWS 2002).

C. Factors Affecting the Species and Critical Habitat in the Action Area

1. Hydroelectric Development and Water Diversions

Battle Creek flows have been diverted for hydroelectric development, irrigation, and hatchery operations (USFWS 2001). Flows vary seasonally and range from 30 cfs in August to 8,000 - 20,000 cfs during spring. The current anadromous habitat in the Battle Creek watershed is strongly influenced by the Battle Creek project, which consists of five powerhouses, two small storage reservoirs, three forebays, five diversions on the north fork Battle Creek, three diversions on the south fork Battle Creek, numerous tributary and spring diversions, and a network of some 20 canals, ditches, flumes, and a pipeline. Small feeder dams divert water from secondary streams into the projects canals. The Ripley and Soap Creek feeders divert additional tributary water into the Inskip and South Canal, respectively. The Asby Diversion Dam feeds water into the Coleman Canal on Baldwin Creek. Dam construction and operations had extirpated most of the original salmonid populations in Battle Creek by the early 1900s, and continue to have an impact on salmon and steelhead by limiting their habitat and availability of water during high water demands.

2. Coleman NFH Barrier Weir and Ladder Operations

The existing fish ladder is designed to pass 40 cfs of water to meet flow criteria during the dry season when fall-run Chinook are migrating. Fish successfully escape over the weir into Battle Creek during broodstock collection when laminar flows greater than 350 cfs occur over the apron of the barrier weir. Upper Battle Creek is open to passage from early March through July 31.

The barrier weir is operated to limit the availability of upstream habitat from hatchery fall-run Chinook salmon, and ensures broodstock collection for artificial propagation. The closure of the upstream fish ladder from August 1 through early March prevents further passage into upper

Battle Creek. After biological data is collected, winter- and spring-run Chinook salmon, and steelhead may be passed upstream of the barrier weir. Potential adverse effects on adults from operation of the fish barrier weir includes delaying upstream migration, rejecting the weir or fishway structure and spawning downstream of trap (displaced spawning), falling back downstream after passing upstream, being injured or killed as adults attempt to jump the barrier, and induced stress by handling.

3. <u>Carrying Capacity of Lower Battle Creek</u>

Fall-run Chinook salmon competition over spawning habitat may be significant during years of high escapement into lower Battle Creek. The AFRP escapement goal for lower Battle Creek is 5,000 adults, based on estimates of spawning habitat availability; however, this has proven to be an underestimate for some years (USFWS 2001). Much of this habitat is occupied by hatchery fish. Juvenile steelhead rear in lower Battle Creek, and may compete with fall-run juveniles. Returning adult hatchery fish that do not or cannot enter the fish ladder may compete with the natural population or stray out of the home stream into other tributaries or basins (CDFG/NMFS 2001).

Battle Creek is closed to fishing all year from its mouth to the Coleman NFH weir; fishing is allowed from 250 feet upstream from Coleman NFH to the Coleman Powerhouse, from the last Saturday in April through September 30 (CDFG 2004). There is no recreational fishery in lower Battle Creek, in order to protect rearing juvenile steelhead and minimize snagging activity (H. Rectenwald, CDFG, pers. comm.). To minimize the impacts of hatchery fish in years of high escapement to Battle Creek, Coleman NFH allows a greater number of fish to enter the hatchery and spawns non-listed Central Valley fall-/late fall-run Chinook salmon (*O. tshawytscha*) numbers beyond their broodstock needs, donating the fish to food banks. All natural steelhead entering the hatchery are bypassed into upper Battle Creek, except for those utilized for broodstock that are released downstream after gamete extraction.

4. <u>Hatchery Operations</u>

Coleman NFH was authorized by the Central Valley Project (CVP) and constructed by Reclamation as mitigation for the loss of 187 miles of historical salmonid spawning and rearing habitat blocked by the construction of Shasta and Keswick Dams (Black 2001, USFWS 2001). The hatchery was constructed on Battle Creek in 1942, and fish culture operations began in 1943. Coleman NFH fish contribute to commercial and recreational fisheries and are used in research and migration studies. Coleman NFH annual production release goals include: 12 million 3-inch Central Valley fall-run Chinook salmon smolts; 1 million 5-inch Central Valley late fall-run Chinook salmon smolts; and 600,000 8-inch Central Valley steelhead smolts.

All broodstock enter the hatchery fish ladder from Battle Creek, but some natural late fall-run fish also are trapped annually at Keswick Dam for incorporation into the late fall-run culture program. Chinook salmon fish production releases occur in Battle Creek from Coleman NFH; fish reared for monitoring studies are generally released at study sites, typically with the Delta region system.

5. Monitoring

Fish monitoring in Battle Creek occurs at the Coleman NFH barrier dam by video monitoring and trapping, adult distribution snorkel surveys, and juvenile trapping via rotary screw trap. Data is collected on (1) adult numbers; (2) run-timing of adult migration; (3) age, size and gender of adults; (4) spawn timing; (5) location of spawning; (6) weight and condition of juveniles; (7) timing of juvenile emigration; (8) size of emigrating salmonids; (9) number of juveniles produced; and (10) potential limiting factors at various life stages. All fish released into upper Battle Creek from Coleman NFH are first passed through a tunnel-type detector to identify coded wire tagged (CWT) fish. Tagged fish are euthanized for CWT data analysis.

Upstream adult fish passage is monitored at Coleman NFH using live trapping from early March 1 through May 27, and followed by underwater videography until July 31. A false-bottom fish trap is used to capture Chinook salmon and steelhead as they pass through the upstream fish ladder at the barrier weir. The trap is located in the upstream end of the vertical slot fish ladder, and is operated 7.5 hours per day. Trapping is terminated for the season and video taping begins when water temperatures exceed 60 degrees Fahrenheit (^{o}F) for a majority of the trap operation period in a day. Tissue samples from fish taken in the barrier weir trap and carcasses are collected for genetic analysis. Stream surveys are conducted from May to mid-November in the North Fork, South Fork, and the mainstem of Battle Creek (USFWS Monitoring Draft 2002).

Battle Creek’s out-migrating juveniles are monitored by rotary screw traps located 2.8 miles and 6.0 miles upstream from the confluence of Battle Creek and the Sacramento River.

6. Habitat Restoration

Under a 1999 Memorandum of Understanding (MOU), the Reclamation, USFWS, CDFG, NMFS, and PG&E made the commitment to restore 42 miles of upper Battle Creek to salmonid habitat, with an additional 6 miles of restoration in its tributaries, through increased minimum instream flows, dam removal, and other improvements in fish passage. NMFS recently completed consultation on the Battle Creek Salmon and Steelhead Restoration project (NMFS 2005), which is expected increase high quality instream habitat by 300 to 500 percent over current levels. The goal of the restoration effort is to facilitate recovery of natural salmonid populations in Battle Creek by restoring the Battle Creek watershed, under the guidance of the Central Valley Project Improvement Act (Public Law 102-575 Section 3401 et seq. CVPIA) and Anadromous Fish Restoration Program (AFRP). The integration of Coleman NFH operations with efforts to restore natural salmon and steelhead populations in the Sacramento River basin is integral to the project. As outlined in the 1999 MOU, the following facility changes in upper Battle Creek would occur:

- Removal of the South, Wildcat, Lower Ripley Creek, and Soap Creek diversion dams and appurtenant facilities.

- Removal of Coleman Dam, but retention of Coleman Canal to function as a conduit to Coleman Powerhouse.

- Construction of new fish screens and fish ladders at the Inskip, North Battle Creek Feeder, and Eagle Canyon diversion dams.

- Construction of a tailrace connector between the Inskip Powerhouse and Coleman Canal. Inskip Powerhouse would be replaced with a new system and integrated with this new tailrace connector.

- Construction of a tailrace connector tunnel between South Powerhouse and Inskip Canal. Water leaving South Powerhouse would be conveyed through the tunnel and outlet works to Inskip Canal. The existing South Powerhouse bypass would be integrated with the new tailrace connector.

The purpose of the new tailrace connectors is to convey water directly from the South and Inskip Powerhouses to associated downstream canals to avoid returning this water into Battle Creek. This structural change to the system is expected to meet several fishery restoration goals, including allowing stream habitat to stabilize, improving the ability of spawning fish to return to their natal areas and preventing North and South Battle Creek waters from mixing, thereby eliminating the potential for false attraction of fish into the wrong (non-natal) fork of the creek (Reclamation 2001).

The restoration project also includes several operational changes to the hydroelectric facilities on Battle Creek. The minimum instream flow releases would be increased at North Battle Creek Feeder (47 cfs summer flows), Eagle Canyon (35 cfs summer flows), Inskip (40 cfs summer flows), and Asbury (5 cfs summer flows) Diversion Dams. At the sites on the stream where the dams are removed, the flow releases from the upstream dams would not be diverted and would be augmented by accretion flows. The new minimum instream flow requirements also include ramping rates to provide gradual changes in water surface elevation.

It is expected that project construction will require 2.5 years to complete, and an estimated 20,000 salmon and steelhead may be produced in a fully-restored Battle Creek watershed (Kier and Associates 1999).

V. EFFECTS OF THE ACTION

Pursuant to Section 7(a)(2) of the ESA (16 U.S.C. §1536), Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This biological opinion assesses the effects of the Coleman National Fish Hatchery Fish Barrier Weir and Ladder Modification project on Central Valley spring-run Chinook salmon and Central Valley steelhead. The project, in cooperation with Reclamation, is expected to facilitate the availability of spawning habitat for spring-run Chinook salmon and steelhead without competition from fall-run Chinook salmon, but it is likely to adversely affect listed species through implementation of its fish rescue plan, which entails seining and possible electrofishing as a capture method. Implementation of the project is likely to adversely affect critical habitat through activities such as: excavation and vegetation removal; dewatering of the creek within the project area; temporary stockpiling and sidecasting of soil, construction materials and wastes; construction of temporary access roads, soil compaction; dust and water runoff from the construction site; fording the creek with heavy equipment or construction of a temporary crossing to access the south bank; and construction-related noise. In the *Description of the Proposed Action* section of this Opinion, NMFS provided an overview of the action. In the *Status of the Species* and *Environmental Baseline* sections of this Opinion, NMFS provided an overview of the threatened and endangered species and critical habitat that are likely to be adversely affected by the activity under consultation.

Regulations that implement section 7(b)(2) of the ESA require biological opinions to evaluate the direct and indirect effects of Federal actions and actions that are interrelated with or interdependent to the Federal action to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. §1536; 50 CFR 402.02). Section 7 of the ESA and its implementing regulations also require biological opinions to determine if Federal actions would destroy or adversely modify the conservation value of designated or proposed critical habitat (16 U.S.C. §1536).

A. Approach to the Assessment

NMFS generally approaches "jeopardy" analyses in a series of steps. First, we evaluate the available evidence to identify the direct and indirect physical, chemical, and biotic effects of proposed actions on individual members of listed species or aspects of the species' environment (these effects include direct, physical harm or injury to individual members of a species; modifications to something in the species' environment - such as reducing a species' prey base, enhancing populations of predators, altering its spawning substrate, altering its ambient temperature regimes; or adding something novel to a species' environment - such as introducing exotic competitors or a sound). Once we have identified the effects of an action, we evaluate the available evidence to identify a species' probable response (including behavioral responses) to those effects to determine if those effects could reasonably be expected to reduce a species' reproduction, numbers, or distribution (for example, by changing birth, death, immigration, or emigration rates; increasing the age at which individuals reach sexual maturity; decreasing the age at which individuals stop reproducing; among others). We then use the evidence available to determine if these reductions, if there are any, could reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

The regulatory definition of adverse modification has been invalidated by the courts. Until a new definition is adopted, NMFS will evaluate destruction or adverse modification of critical habitat by determining if the action reduces the value of critical habitat for the conservation of the species.

To conduct this assessment, NMFS examined evidence from a variety of sources. Detailed background information on the status of these species and critical habitat was obtained from a number of documents including the Action Specific Implementation Plan, peer reviewed scientific journals, primary reference materials, government and non-government reports, project-specific environmental reports, and project meetings.

B. Assessment

The proposed Coleman NFH Fish Barrier Weir and Ladder Modification project will provide a more effective barrier weir to Central Valley fall-run Chinook salmon escapement into upper Battle Creek, and will contribute to the maintenance of isolation between the Central Valley spring- and fall-run Chinook salmon spawning populations to retain the genetic integrity of both runs, as restoration in upper Battle Creek is being implemented. The barrier weir may also be used to prevent Central Valley steelhead hatchery fish from spawning in-river with the natural population. By doing so, the project will contribute to the restoration of salmon and steelhead stocks in conjunction with the restoration of salmonid habitat through its association with the Battle Creek Salmon and Steelhead Restoration project. Overall, it is expected that the proposed project will benefit the conservation value of critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead spawning and rearing in the upper Battle Creek.

There is the potential for some short-term, adverse impacts which would be expected to occur primarily during the construction phase of the project, and some long-term impacts which will be compensated for as shaded, riverine aquatic habitat is recovered and the project site is restored. There is the potential for some immediate or delayed adverse impacts, resulting from fish capture by seining or electroshocking, and containment and transportation for release, due to fish rescue operations. All instream work will be conducted between June 1 and September 30 to minimize the risk of impacting listed salmonids. The avoidance, minimization, and conservation measures that have been incorporated into the project design are expected to greatly reduce the likelihood and severity of fish rescue and construction impacts. Adverse impacts to salmonid habitats and their functional value will be compensated by in-kind replacement onsite. The project will be monitored to ensure the implementation of BMPs and conservation measures are effective in avoiding or minimizing detrimental effects to listed salmon and steelhead, and critical habitat. Appropriate implementation of BMPs and conservation measures is expected to reduce the potential impacts to water quality in particular to the level that they would not be likely to adversely affect listed salmonids.

1. Construction Effects

a. *Construction of Access Corridor*

Heavy equipment will cross the creek channel multiple times to access the south bank for placement to access the area for excavation, in close proximity to the creek banks. Effects of the action may include soil compaction of the streambank and substrate, impairment to ecological connectivity, removal of riparian vegetation on the banks of Battle Creek, erosion of the streambank, and increased sedimentation into Battle Creek. Sedimentation may impair spawning substrate (although most listed salmonids spawn farther upstream) and rearing habitat, and cause the mortality of fish eggs, fish larvae, and rearing juveniles. Juveniles and adults may become stressed and avoid or leave preferred habitats if those habitats are injected with high concentrations of suspended sediment, and migration may be delayed. Juveniles in particular may incur reduced feeding and growth rates, and increased likelihood of predation if they are frightened into deeper, open-water habitat. Juveniles, which are less able swimmers than adult fish, may be crushed if they are trapped by heavy equipment and cannot escape.

The project will limit the effects from construction of the access corridor by utilizing existing roads and access points to the greatest extent possible. The construction equipment will be limited in use to the construction footprint, access corridor, and areas specifically designated for machine maintenance and storage. All natural woody riparian or SRA habitat will be avoided or preserved to the maximum extent practicable. Trees that are cut will regrow rapidly as the remaining root systems should remain viable after construction. Equipment will either ford the creek or use a stream crossing with a culvert design that meets NMFS Southwest Region guidelines (NMFS 2001). Impacted areas will be replanted to provide 100 percent replacement with native woody species. SRA habitat is expected to continue to function adequately due to the localized and temporary nature of the construction impacts. Implementation of the environmental conservation measures is expected to avoid or minimize to the extent possible the effects of sedimentation from the construction of the access corridor.

b. *Accidental Spills*

Accidental spills related to construction activities or hazardous materials may cause habitat degradation and result in fish mortality or reduce productivity of fish and other aquatic species. The project will avoid or minimize impacts from accidental spills by implementing the Spill Prevention and Containment Plan (SPCP) conservation measures for off-site disposal of contaminated soils and the storing of hazardous materials to areas protected from direct runoff. All staging and storage areas will lie outside of the stream zone. Areas for refueling machinery and for storing hazardous materials will be set back a minimum of 100 feet from Battle Creek. Marked areas away from direct runoff will also be provided for fluid inspection, washing, and any rebuilding, of equipment.

Any accidental spills will be cleaned up immediately, and RWQCB, NMFS, and CDFG will be notified of the event for further direction. To minimize the effect of a potential oil leak, the contractor will utilize biodegradable oils in the hydraulic systems of equipment used for instream work, which will also be beneficial to areas regarding any spills occurring outside of the streambed.

c. *Excavation and Vegetation Removal*

Construction of temporary access corridors for the project includes the removal of 360 linear feet of SRA vegetation habitat. Impacts to stream banks, vegetation and cover may cause streambank destabilization and an increase in nutrient inputs, a reduction of bank cover shading, and an increase in stream temperatures, inducing stress to salmonids. The destruction of riparian trees will also reduce the supply of large woody debris, diminishing instream habitat diversity by removing the source of materials responsible for creating pools and riffles which are critical for anadromous fish growth and survival. A decrease in habitat complexity and water of preferred depths or velocities will also affect the availability of refugia, especially for juvenile salmonids.

The disturbed structure of the soil may lead to increased sedimentation into Battle Creek. Increases in suspended inorganic sediment concentrations can be deleterious to filter-feeding invertebrates and to fish, which exhibit avoidance behavior and negative physiological responses (Owens *et al.* 2005). Temporary sediment control measures will be located at disturbed areas to prevent sediment from entering Battle Creek, and kept in place until they are stabilized. To offset erosion and sedimentation over-winter, conservation measures such as the use of mulch, straw wattles, and silt fences will be implemented, and further recommendations may be included as part of the SWPPP developed for the project in conjunction with the RWQCB. As a precaution, water quality will be monitored for turbidity and settleable materials according to the RWQCB Section 401 Water Quality Certification standard conditions.

Impacted areas will be reseeded or replanted with native plant species to prevent soil erosion, in coordination with an erosion control specialist. The amount of SRA habitat and riparian vegetation to be removed will be approximately 0.4 acres (17,424 square feet) on the grounds adjacent to Battle Creek, a small area relative to the total SRA available in the action area, and is not anticipated to be extensive enough to cause water temperature increases. The loss is not expected to injure juveniles because they should be able to locate adequate feeding sites and refugia nearby; other life stages are not likely to be adversely affected. Areas that have not successfully re-established themselves within 3 years will be replanted with native vegetation to re-establish shaded refugia and habitat structure. Post-project monitoring will evaluate the success of the restoration, and assist in identifying areas needing further revegetation to meet the goal of 100 percent replacement of value of habitat impaired by the project.

d. *Construction of Cofferdams*

Cofferdams will be constructed with washed spawning-sized gravel, riprap and geotechnical fabric, and be constructed in a manner that will avoid or minimize further sediment discharge. Gravel may be collected from deposits outside of active stream channels at or above the 100 year flood plain. Gravel extraction from sites outside of active stream channels may affect future natural deposition, as gravel could enter the stream over time, either through wash, or erosion and gravity. Heavy equipment, processing areas and gravel stockpiles at or near the extraction site would compact soil, remove sources of large woody debris and disrupt stream interconnectedness of channels and riparian systems. Cofferdam construction will occur in or near the stream channel, and is expected to physically disturb the stream channel, increase turbidity and suspended sediment, and may alter channel dynamics and stability in the short-term.

Disruption of stream and riparian connectivity, and changes in stream profile, morphology and substrate stability outside of the excavated area's perimeter could occur during subsequent high water events. Active channels may naturally meander into the excavated area and fish may be stranded during flooding. Stockpiles and overburden left in the floodplain may alter channel hydraulics during high flows; however, gravel extraction within the project footprint would be restored to pre-project conditions.

The placement of gravel in Battle Creek may kill or injure less mobile juvenile salmonids by crushing if gravel is dumped directly on them. The project will be monitored prior to gravel placement to ensure that impacts from gravel placement are minimal or avoided, and all contracted personnel will be trained to discern the risk of fish being present at the site. Fishery biologists may survey the area prior to gravel placement to make a determination of fish presence and to implement fish rescue operations.

The bottom foot of cofferdam gravel will remain in the creek over-winter through the construction period and left in place upon completion of the project for salmonid spawning (primarily non-listed Central Valley fall-run Chinook salmon) and rearing habitat enhancement. Additional gravel input into lower Battle Creek is expected to contribute to spawning success of Central Valley steelhead and Chinook salmon by increasing the availability of gravel of appropriate size and permeability. Past work in other Central Valley streams has indicated that gravel enhanced riffles are used for spawning by anadromous salmonids, and that it is possible that their use increases over time as the gravel “seasons.” (J. McLain, NMFS, pers. comm.). This will allow juveniles to choose habitat depths and velocities appropriate for their size, which should allow them to maximize their food intake while minimizing their energy their energy expenditures, which in turn should contribute to their growth and likelihood of survival.

e. *Dewatering and Fish Rescue Activities*

Adult and especially juvenile salmonids may become stranded during the dewatering process. During de-watering, fish biologists will snorkel or dive in the impacted area to estimate the numbers and types of fish which may become stranded. Based on this information, fish rescuers will decide which rescue method is most appropriate to employ. Seining is the preferred methodology, but rescuers may employ electroshockers, if necessary. A crew of fishery biologists will be on stand-by for possible implementation of real-time fish rescue operations after the installation of the cofferdams. This process will be carried out in June, when adult winter- and spring-run Chinook salmon may be present, and juvenile fall-/late fall-run Chinook salmon will be rearing in lower Battle Creek. Following professional protocols of fish capture and holding, the adult fish will be released upstream of the project site, and juvenile fish will be released downstream of the site, before construction resumes on the project.

Stranding may cause stress to fish by forcing them to occupy shallow pools of standing water that may have elevated temperatures and lower dissolved oxygen available. Fish may injure themselves as they try to escape. Likewise, capture and handling fish may cause stress, physical injury, or death. Pre-placement monitoring and careful placement of the gravel during cofferdam construction is expected to minimize the number of fish stranded (see *Construction of Cofferdams*, above). Adverse effects are expected to be minimized further by employing experienced fish biologists to carry out the rescue activities.

Approximately 525 linear feet or 0.9 acres (39,204 square feet) of Battle Creek, will remain dewatered during the instream construction window (June 1 to September 30). The spawning and rearing habitats of adult winter- and spring-run Chinook salmon in the upper reaches of Battle Creek will not be affected. The presence of winter-run Chinook salmon in Battle Creek has been rare in recent years, and therefore very few individuals are likely to be exposed to the adverse effects of instream construction. Migrating spring-run Chinook salmon are found in Battle Creek from mid-March through mid-October, and all but a few are expected to pass Coleman NFH by the end of July. Mature steelhead will begin to enter Battle Creek in August, midway during the instream construction season. All three species will have access to higher elevations of Battle Creek from June 1 through July 31, after which a picket weir will be placed at the downstream end of the diversion channel. Any adult spring-run Chinook salmon and steelhead holding below the diversion channel may enter Coleman NFH when the ladder is open for fall-run Chinook salmon broodstock collection, and will be handled according to standard hatchery operations. Juvenile Chinook salmon and steelhead may be in residence in Battle Creek downstream of the weir, although rearing is not thought to be likely to occur at the project site during the instream construction window because of non-optimum water temperatures (Table 1). Rearing habitat will be decreased by 0.9 acres over two to three work construction seasons. This amount is considered minor in relation to the non-affected remaining amount of habitat in Battle Creek. The instream construction work window chosen for the project is considered to be the least impacting on the life stages of salmonids expected to be present in Battle Creek.

f. *Diversion Channel*

Migrating salmon and steelhead upstream and downstream of the channel may be delayed during the time Battle Creek is being dewatered and when flows are being diverted through the excavated channel. However, dewatering will be completed over the course of a day, during which fish will have the ability to migrate past the project area. To offset possible delays in out-migration, the diversion channel has been designed to match the water depth and velocity parameters of Battle Creek, and should not impair volitional fish passage. Channel modifications within natal, rearing, and migratory habitats that may result in habitat degradation and diminished habitat connectivity are expected to be temporary. Chinook salmon and steelhead adults and juveniles may experience short-term delays in migration during diversion of Battle Creek flow through the channel in June and July, before the picket weir barrier is put in place on August 1st. At the completion of the project, the channel and cofferdams will be deconstructed, the supporting structures will be removed, and the diversion channel will be filled to restore the south bank topography to its pre-project condition. Therefore, no long-term impacts to habitat are anticipated.

g. *Blasting*

Blasting, if necessary, will be done in the dry or on land; no underwater blasting has been proposed. Blasting activities near the stream channel may generate percussion-related shock waves via hydrostatic pressure that could cause injury or death of eggs, larvae, juvenile and adult fish. Internal organs, especially swim bladders of all non-embryonic life stages of fish, are vulnerable to rupture from the effects of underwater blasting (rapid increase of hydrostatic pressure and subsequent decreases to below ambient pressures). Sublethal effects of vibration, such as movement of fish into less suitable habitats, have also been reported (Bonneville Power Administration 2002). When blasting in rock occurs near, but not within, the active watercourse, water pressure is generated by seismic waves (Oriad 1985). The maximum transferred energy ratio of these waves is produced when the substrate is solid, unbroken rock and the rock/water boundary is perpendicular. Under these conditions, the energy transfer ratio is approximately 37 percent. The amount of energy transferred decreases slowly as the slope of the boundary layer decreases from the perpendicular. The slower increase of pressure decreases the risk of bursting a fish's air bladder or other structural damage (Oriad 1985).

The Canadian Department of Fisheries and Oceans (Wright and Hopky 1998) has developed blasting guidelines for on-shore setback distances from fish habitat based on substrate type to meet the maximum pressure guideline of 100 kilopascals (kPa) to avoid physical impacts to fish, based on the weight of the charge used. These guidelines apply to the Battle Creek Salmon and Steelhead Restoration project (NMFS 2005). It is expected that the current project will follow suit in consulting the guidelines, should it be necessary to carry out blasting as a construction action.

h. *Pile-Driving and Dredging*

Cofferdam construction may require pile-driving or dredging, although the use of these methods is not considered likely. If pile-driving occurs, however, it would involve sheet pile installation into the riverbed with either a vibratory or mechanical hammer. The force of the hammer hitting a pile forms a sound wave that travels down the pile and causes the pile to resonate radially and longitudinally. Acoustic energy is formed as the walls of the steel pile expand and contract, forming a compression wave that moves through the pile. The outward movement of the pile wall sends a pressure wave propagating outward from the pile and through the riverbed and water column in all directions. Sheet pile driving for the Battle Creek Salmon and Steelhead Restoration project was expected to generate of sound levels of 120dB to 160dB (NMFS 2005). Sound levels would be expected to be similar for this project due to the likely similar methodology and stream conditions (*e.g.*, water depth and velocity). Sheet pile driving may cause startle and avoidance responses in juvenile salmonids (McKinley and Patrick 1986), but these sound levels would not be expected to cause injury or death of these fish. To monitor the project for noise and shock disturbance effects of dredging and possible sheet-piling, a hydrophone will be placed within the area's water perimeter to monitor sound waves. A "bubble curtain" will be placed around the sheet pile that dissolves waves while the pile is hammered into the ground, should in-water sounds waves be greater than 120 decibels within a 10-meter radius and 1-meter deep.

Dredging required for cofferdam construction likely would involve a relatively small amount of sediment removal, but could increase suspended sediment and turbidity levels in Battle Creek. High turbidity affects salmonids by reducing feeding success, causing avoidance of rearing habitats, and disrupting upstream and downstream migration. Displacement of juveniles from preferred habitats may cause increased susceptibility of juveniles to predation. If dredging occurs, suspension of sediments in the water will be minimized by the use of BMPs and turbidity will not exceed the limits established by the RWQCB.

2. <u>Habitat Impacts</u>

The proposed project will result in the temporary disturbance of in-channel habitat and the temporary loss of SRA and riparian habitat due to construction activities. In-channel physical disturbances due to excavation and heavy equipment operation, and associated increases in turbidity and suspended sediment, are expected to be localized and short-lived. Proposed conservation measures such as removing fines from the gravel before adding it to the stream, and installing erosion control devices adjacent to work areas are expected to avoid or minimize construction impacts to habitat. Also, loss of SRA and riparian habitat is expected to be small relative to the overall availability and will be avoided to the maximum extent practical; disturbed areas will be replanted to provide 100 percent replacement of native woody species after three years. The addition of gravel will enhance the function of the habitat for juvenile rearing by contributing to habitat complexity through the creation of riffles adjacent to pools. This will allow juveniles to choose habitat depths and velocities appropriate for their size, which should allow them to maximize their food intake while minimizing their energy expenditures, which in turn should contribute to their growth and likelihood of survival.

3. <u>Monitoring Impacts</u>

The proposed project will have three monitoring components including: (1) monitoring during project implementation to ensure that conservation measures and BMPs are implemented; (2) post-project adaptive management monitoring to assess how well the project has met the objectives with regard to passage management; and (3) post-project monitoring of site restoration and mitigation including revegetation. Monitoring elements are described in Table 8-1 and elsewhere in the ASIP. Many monitoring elements will focus on ensuring construction BMPs and revegetation activities are successfully implemented, and are not likely to adversely affect listed salmonids. However, monitoring of salmonids likely will involve handling and tagging of fish. Monitoring of salmonids in Battle Creek is an ongoing activity, and additional monitoring is expected to occur as part of the Battle Creek Restoration project (see the *Environmental Baseline* section). Salmonid monitoring associated with the Coleman NFH Fish Barrier Weir and Ladder Modification project is expected to be closely linked to these other monitoring programs.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Non-Federal actions that may affect the action area include voluntary State or privately-sponsored habitat restoration activities, agricultural practices, livestock grazing and water withdrawals/diversions. Farming activities within or adjacent to the action area may have negative effects on water quality due to runoff laden with agricultural chemicals. Water withdrawals/diversions may result in entrainment of individuals into unscreened or improperly screened diversions, and may result in depleted river flows that are necessary for migration, spawning, rearing, flushing of sediment from spawning gravels, gravel recruitment and transport of LWD.

VII. INTEGRATION AND SYNTHESIS

Populations of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead have declined drastically over the last century, and their current status has not significantly improved to warrant their delisting. A major cause of the decline is habitat loss or severe impairment of habitat quality and function. Most of this habitat loss and degradation has resulted from anthropogenic watershed disturbances caused by dams, water diversion, flood control structures and activities, farming, urban development, logging, and gravel mining.

The proposed Coleman NFH Fish Barrier Weir and Ladder Modification project is intended to improve fish passage management capabilities on Battle Creek at the Coleman NFH fish barrier weir and upstream fish ladder. This is expected to contribute to the maintenance of isolation between the Central Valley spring- and fall-run Chinook salmon spawning populations to retain the genetic integrity of both runs, as restoration in upper Battle Creek is being implemented. The barrier weir may also be used to prevent Central Valley steelhead hatchery fish from spawning in-river with the natural population. By doing so, the project will contribute to the conservation of salmon and steelhead in conjunction with the restoration of salmonid habitat through its association with the Battle Creek Salmon and Steelhead Restoration project.

There is the potential for some short-term, adverse impacts which would be expected to occur during the construction phase of the project over three seasons; however, inwater work only will occur between June 1 and September 30. The use of this inwater work window is expected to minimize the exposure of Central Valley spring-run Chinook salmon and Central Valley steelhead to the direct effects of project construction resulting from heavy equipment crossing the stream channel, excavation, construction of cofferdams using gravel and riprap, and other construction activities. Specifically, most migrating adult spring-run Chinook salmon are expected to pass Coleman NFH from March through the end of July. Although construction will begin June 1, these fish will continue to have access to higher elevations of Battle Creek from June 1 through July 31 by way of diversion channel. Mature steelhead will begin to enter Battle Creek in August, midway during the instream construction season. Any adult spring-run Chinook salmon and steelhead holding below the diversion channel after July 31 may enter Coleman NFH when the ladder is open for fall-run Chinook salmon broodstock collection, and will be handled according to standard hatchery operations. Rearing juvenile salmonids may occur near the project site year-round, but are thought to be less likely to be present during the instream construction window because of non-optimum water temperatures. The presence of winter-run Chinook salmon in Battle Creek has been rare, and therefore few individuals are expected to be exposed to the adverse effects of instream construction.

The avoidance, minimization, and conservation measures that have been incorporated into the project design are expected to further reduce the likelihood and severity short-term construction impacts. These include designating work zones and exclusion zones, avoiding and minimizing impacts to water quality through implementation of a SWPPP and SPCP, and slowly and carefully conducting excavating and fill activities to allow wildlife (*e.g.*, juvenile salmonids) to escape in advance of machinery and advancing soil. Overall, only a small number of adult and juvenile Central Valley spring-run Chinook salmon and Central Valley steelhead are anticipated to be adversely affected by construction impacts of the proposed project. Adverse impacts may include delays in migration or behavioral changes such as temporary cessation of feeding, and exhibiting escape or avoidance behaviors. Mortality of juveniles may occur because their small body size and poorer swimming ability increases the likelihood they may be crushed or stranded.

Adverse impacts to salmonid habitats and their functional value will be compensated by in-kind replacement onsite. The project will be monitored to ensure the implementation of BMPs and that conservation measures are effective in avoiding or minimizing detrimental effects to listed salmon and steelhead habitat, including the PCEs of Central Valley spring-run Chinook salmon and Central Valley steelhead critical habitat (*i.e.*, freshwater migration corridors and freshwater rearing sites). Impacts to critical habitat are expected to include the temporary disturbance of in-channel habitat and the temporary loss of riparian habitat due to construction activities, and the introduction of high-quality spawning gravel of appropriate size in lower Battle Creek which will be used primarily by non-listed Central Valley fall-run Chinook salmon. Habitat components within the action area, such as SRA habitat and riparian vegetation, contribute to shoreline habitat complexity and refugia for juveniles, and contribute beneficially to the conservation value of critical habitat. These components will continue to function adequately due to the localized and temporary nature of the construction impacts. Appropriate implementation of BMPs and conservation measures is expected to reduce the potential impacts to water quality in particular to the level that they would not be likely to adversely affect listed salmonids. Potential long-term impacts to a relatively small amount of habitat will diminish and are expected to be fully compensated for over a few years as SRA habitat is recovered, and the riparian area adjacent to the project site is restored.

Fish rescue activities are anticipated to be necessary when cofferdams are closed. There is the potential for some immediate or delayed adverse impacts resulting stress or physical injury due to fish capture by seining or electroshocking, and the containment and transportation necessary for release. The capture and handling of 60 *O. mykiss* and the mortality of 1 *O. mykiss* per year per fish rescue is anticipated. The project proponent plans to implement conservation measures to avoid or minimize adverse effects to Central Valley steelhead from fish rescue operations.

Available data indicate that rearing populations of *O. mykiss* in the lower portion of Battle Creek may number in the thousands, although many individuals may be resident rainbow trout rather than anadromous steelhead. Resident rainbow trout in these locations likely are similar genetically to co-occurring anadromous *O. mykiss*; however, for management purposes, *O. mykiss* may be distinguished as either an anadromous DPS or a resident DPS (71 FR 834). Resident rainbow trout may produce offspring that migrate to the ocean and return to enter the breeding population of steelhead, which would buffer the extinction risk of the population in Battle Creek, and by supporting the continuance of the anadromous life-history form. The requested amount of take is not expected to result in a significant effect at the scale of the DPS because the anticipated mortality rates are low, and the abundance of the population should not be appreciably reduced.

Overall, the project is expected to contribute to the success of the Battle Creek Salmon and Steelhead Restoration project to benefit Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead by allowing selective passage of fish into the newly-available spawning and rearing habitat upstream in Battle Creek. The proposed project will contribute to the long-term viability of the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead populations in Battle Creek, by enhancing population abundance, growth rate, and spatial structure (McElhany *et al.* 2000). Strengthening the Battle Creek populations should in turn contribute to the survival and recovery of the overall Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon ESUs and the Central Valley steelhead DPS.

VIII. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of Central Valley spring-run Chinook salmon and Central Valley steelhead, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the Coleman NFH Fish Barrier Weir and Ladder Modification project, as proposed, is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead, and is not likely to destroy or adversely modify designated critical habitat of Central Valley spring-run Chinook salmon and Central Valley steelhead.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by USFWS so that they become binding conditions of any grant or permit issued to the Contracted Party (Contractor) providing the construction services, for the exemption in section 7(o)(2) to apply. USFWS has a continuing duty to regulate the activity covered by this incidental take statement. If USFWS 1) fails to assume and implement the terms and conditions or 2) fails to require the

Contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, USFWS and the Contractor must report on the progress of the action and its impact on the species and proposed critical habitat to NMFS as specified in the incidental take statement (50 CFR §402.14[i][3]).

A. Amount or Extent of Take

No take of Sacramento River winter-run Chinook salmon is anticipated because they have rarely been observed in the action area in recent years, presumably due to changes in hatchery practices. NMFS anticipates that a total of 105 Central Valley spring-run adults and 3,000 spring-run juveniles could be exposed and taken at the Battle Creek project site over a 3-year period, based on 35 percent of the total adult run average (35 fish) of 100 fish returning to Battle Creek and the average number of 1000 outmigrating spring-run juveniles, during the June 1 to September 30 instream construction window period. Likewise, NMFS anticipates that a total of 237 Central Valley steelhead adults and 4,314 steelhead juveniles could be taken at the Battle Creek project site over a 3-year period, based on the annual averages of 79 adults and 1,438 juveniles monitored in the project site area during the June 1 to September 30 instream construction window period. The incidental take is expected to be in the form of increased stress levels, migration delays, displacement from preferred habitat, capture by seine or electroshocking, handling, transport, and associated monitoring. NMFS anticipates unintentional lethal take of 2 adult and 20 juvenile (< 150 mm FL) Central Valley spring-run Chinook salmon and 4 adult and 29 juveniles (< 250 mm FL) Central Valley steelhead per year in each of the construction seasons in 2006, 2007, and 2008, based on observed rates of lethal take during electroshocking (McMichael *et al.* 1998). Incidental take coverage will extend through the 2008 instream work season or until end of project completion.

The project footprint is not expected to exceed approximately 7.6 ac, consisting of: Battle Creek dewatered, 0.9 ac; south side island work area, 0.5 ac; diversion channel, 1.2 ac; diversion channel spoil pile, 1.6 ac; contractor area, 2.3 ac; cofferdam access roads, 0.2 ac; fish ladder construction area, 0.4 ac; staging area, 0.3 ac; and north side access roads, 0.2 ac.

Anticipated incidental take may be exceeded if project activities exceed the criteria described above or if the project is not implemented as described in the ASIP for the project, including the full implementation of the proposed conservation measures listed in the *Description of the Proposed Action* section.

B. Effect of the Take

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species or the destruction or adverse modification of critical habitat.

C. Reasonable and Prudent Measures.

Pursuant to section 7(b)(4) of the ESA, the following reasonable and prudent measures are necessary and appropriate to minimize take of Central Valley spring-run and Central Valley steelhead:

1. Due to close cooperation between USFWS and Reclamation throughout the planning and development of this project, NMFS believes that all measures which are necessary and appropriate to minimize take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead have been incorporated into the project. Therefore, the only requirement will be for thorough monitoring and reporting to NMFS on the efficacy of the proposed conservation measures and any documented take that results from construction of the project.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the USFWS, in cooperation with Reclamation, must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Due to close cooperation between USFWS and Reclamation throughout the planning and development of this project, NMFS believes that all measures which are necessary and appropriate to minimize take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead have been incorporated into the project. Therefore, the only requirement will be for thorough monitoring and reporting to NMFS on the efficacy of the proposed conservation measures and any documented take that results from construction of the project.

a. The U.S. Fish and Wildlife Service, in cooperation with Reclamation, shall closely monitor all construction activities and report any incidences of take of listed salmonids within 48 hours to NMFS at the contact information below.

b. The U.S. Fish and Wildlife Service, in cooperation with Reclamation, shall provide annual reports to NMFS' Sacramento Area Office (see contact information below) within six months of the close of each instream construction season (*i.e.*, approximately March 1, following an October 1 close of construction). These reports shall include: a summary of total numbers of listed salmonids encountered, captured, or killed during construction and rescue operations; progress on construction elements and updated timelines for project completion; and efficacy of the conservation measures and descriptions of any unforeseen problems or incidents that may have affected listed salmonids.

c. The U.S. Fish and Wildlife Service, in cooperation with Reclamation, for the purposes of agency review and approval shall provide to NMFS at least 14 days prior to implementation the finalized project plans describing the following:

- any chemically-treated substances that will be used during the instream construction window;
- the final stream crossing design;
- the source location of gravel and extraction methodology, if the area is within Battle Creek watershed;
- the design specifications and installation process for the crest cap and overshot gate to the existing barrier weir;
- any pile-driving or dredging activities; and,
- the final area of deposition of project spoils.

d. The U.S. Fish and Wildlife Service, in cooperation with Reclamation, for the purposes of agency review and approval shall provide to NMFS at least 60 days prior to implementation the finalized project plans describing the following:

- any blasting activities; and
- any monitoring of anadromous salmonids occurring during, pre-, or post-project.

Updates and reports required by these terms and conditions shall be submitted to:

Office Supervisor
NMFS
Sacramento Area Office
650 Capitol Mall, Suite 8-300
Sacramento, CA 95814

Phone (916) 930-3600
Fax (916) 930-3629

X. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

NMFS believes the following conservation recommendation is consistent with these obligations, and therefore should be implemented by USFWS and Reclamation.

a. The U.S. Fish and Wildlife Service and Reclamation should continue to work cooperatively to implement the screening of Coleman NFH water supply intakes.

> This screening project will further integrate Coleman NFH operations/management with salmonid restoration activities in Battle Creek. Specifically, the intake screening project has been identified as necessary for protecting restored runs of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead in the Battle Creek watershed.

In order for NMFS to be kept informed of actions avoiding or minimizing adverse effects or benefitting listed species or their habitats, NMFS requests notification of implementation of the conservation recommendation.

XI. REINITIATION OF CONSULTATION

This concludes formal consultation on the action(s) outlined in the March 12, 2004 request for consultation received from the USFWS. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded, 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion, 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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Enclosure 2.

<u>Magnuson-Stevens Fishery Conservation and Management Act (MSA)</u>

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS[1]
Coleman National Fish Hatchery Fish Barrier Weir and Ladder Modification Project

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The geographic extent of freshwater essential fish habitat (EFH) for the Pacific salmon fishery is proposed as waters currently or historically accessible to salmon within specific U.S. Geological Survey hydrologic units (Pacific Fisheries Management Council 1999). EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

The associated biological opinion (Enclosure 1) thoroughly addresses the species of Chinook salmon listed both under the Endangered Species Act (ESA) as well as the MSA which potentially will be affected by the proposed action—Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley spring-run Chinook salmon (*O. tshawytscha*). Therefore, this EFH consultation will concentrate primarily on the Central Valley fall/late fall-run Chinook salmon (*O. tshawytacha*) Evolutionarily Significant Unit (ESU) which is covered under the MSA, although not listed under the ESA.

The Sacramento, Feather, Yuba, American, Cosumnes, Mokelumne, Stanislaus, Tuolumne, Merced, and San Joaquin Rivers, and many of their tributaries, support wild populations of Central Valley fall-/late fall-run (herein "fall-run") Chinook salmon. However, 40 to 50 percent of spawning and rearing habitats once used by these fish have been lost or degraded. Fall-run Chinook salmon once were found throughout the Sacramento and San Joaquin River drainages, but have suffered declines since the mid-1900s as a result of several factors, including commercial fishing, blockage of spawning and rearing habitat, water flow fluctuations, unsuitable water temperatures, loss of fish in overflow basins, loss of genetic fitness and habitat competition due to straying hatchery fish, and a reduction in habitat quality.

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[1] The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) set forth new mandates for the National Marine Fisheries Service (NMFS) and federal action agencies to protect important marine and anadromous fish habitat. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding potential adverse effects of their actions on EFH, and respond in writing to NMFS "EFH Conservation Recommendations."

Chinook salmon in the Sacramento/San Joaquin Basin are genetically and physically distinguishable from coastal forms (Clark 1929). Additionally, San Joaquin River populations tend to mature at an earlier age and spawn later in the year than Sacramento River populations. These differences could have been phenotypic responses to the generally warmer temperature and lower flow conditions found in the San Joaquin River basin relative to the Sacramento River basin. There is no apparent difference in the distribution of marine coded wire tag (CWT) recoveries from Sacramento and San Joaquin River hatchery populations, nor are there genetic differences between Sacramento and San Joaquin River fall-run populations (based on DNA and allozyme analysis) of a similar magnitude to that used in distinguishing other ESUs. This apparent lack of distinguishing life-history and genetic characteristics may be due, in part, from a high percentage of fish straying from the practice of hatchery trucking of Central Valley fall-run Chinook salmon into the San Joaquin River basin for release into San Pablo Bay.

The historical abundance of fall-run Chinook salmon is poorly documented (Myers *et al.* 1998) and complete estimates are not available until 1953 (U.S. Fish and Wildlife Service (USFWS) 1995). From the late 1930s to the late 1950s estimates for mainstem Sacramento River fall-run fish were obtained from spawning surveys and ladder counts at the Anderson-Cottonwood Irrigation Dam. Although surveys were not consistent or complete, they did yield population estimates for fall-run Chinook salmon in the Sacramento River ranging from 102,000 to 513,000 fish (Yoshiyama *et al.* 1998). Average escapement from 1953 to 1966 was 179,000 fish and from 1967 to 1991 was 77,000 (USFWS 1995). From 1992 to 1997 the estimated fall-run population in the Sacramento River ranged from 107,000 to 381,000 fish (Yoshiyama *et al.* 1998). Over the last 5 years average escapement of naturally produced fall-run has been above 190,000; 20 to 40 percent of natural spawners are assumed to be of hatchery origin. Due to the relative lack of marked hatchery fall-run production, the percentage of naturally-spawning fish of hatchery origin may actually be greater. The increase in salmon runs in the Sacramento River since 1990 may be attributable to several factors including, increased water supplies following the 1987 to 1992 drought, stricter ocean harvest regulations, and fisheries restoration actions throughout the Central Valley. However, it is unclear if natural populations are self-sustaining or if the appearance of a healthy population is due to high hatchery production. Concern remains over impacts from large-scale artificial propagation programs and fish harvest levels, although ocean and freshwater harvest rates have been recently reduced.

Fall-run Chinook salmon comprise the largest population of Chinook salmon in Battle Creek. Fall-run Chinook salmon were intentionally restricted from entering the Battle Creek Restoration project area because of concern about transmitting infectious hematopoietic necrosis (IHN) into the water supply for the Coleman National Fish Hatchery (USFWS 1997) and potential problems that excessive numbers of fall-run fish pose to the small numbers of spring- and winter-run Chinook salmon. During the past five years of record, an average of about 95,000 adult fall-run Chinook salmon returned to Battle Creek, of which an average of nearly 34,000 were allowed to enter the Coleman National Fish Hatchery. The remaining fall-run Chinook salmon are mostly confined downstream of the Coleman National Fish Hatchery barrier weir, outside the Restoration project area (USFWS 2001). The abundance of fall-run Chinook salmon in the Battle Creek watershed has increased substantially since about 1980. Recent research suggests that as many as one-third of the fall-run Chinook salmon returning to the creek were the product of fish that spawned naturally in lower Battle Creek (USFWS 2001).

A. Life History and Habitat Requirements

Central Valley fall-run Chinook salmon are "ocean-type," entering the Sacramento and San Joaquin Rivers from July through December, and spawning from October through January. Peak spawning occurs in October and November (Reynolds *et al.* 1993). Chinook salmon prefer to spawn in swift, relatively shallow riffles, or along the edges of fast flows at depths up to 15 feet. Preferred spawning substrate is clean loose gravel. Gravels are unsuitable for spawning when cemented with clay or fines, or when sediments settle out onto redds, reducing intergravel percolation (NMFS 1997).

Egg incubation occurs from October through March, and juvenile rearing and smolt emigration occurs from January through June (Reynolds *et al.* 1993). Shortly after emergence from their gravel nests, most fry disperse downstream to reside in the Delta and estuary for several months before entering the ocean (Healey 1980, 1982; Kjelson et al. 1982). Remaining fry stay hidden in gravel or station in calm, shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, tributary streams are used as rearing habitat. These non-natal rearing areas are highly productive micro-habitats providing abundant food and cover for juvenile Chinook salmon to grow to the smolt stage. Smolts are juvenile salmonids that are undergoing a physiological transformation that allows them to enter saltwater. These smolts generally spend a very short time in the Delta and estuary before entry into the ocean.

In contrast, the majority of fry carried downstream soon after emergence are believed to reside in the Delta and estuary for several months before entering the ocean (Healey 1980, 1982; Kjelson *et al.* 1982). Principal foods of Chinook salmon while rearing in freshwater and estuarine environments are larval and adult insects and zooplankton such as *Daphnia*, flies, gnats, mosquitoes or copepods (Kjelson *et al.* 1982), stonefly nymphs or beetle larvae (Chapman and Quistdorff 1938) as well as other estuarine and freshwater invertebrates. All outmigrant Central Valley fall-run Chinook salmon depend on passage through the Sacramento-San Joaquin Delta for access to the ocean. They remain off the California coast during their ocean residence and migration.

II. DESCRIPTION OF THE PROPOSED ACTION.

The proposed action is described in the *Description of the Proposed Action* section of the associated biological opinion (Enclosure 1) for the endangered Sacramento River winter-run Chinook salmon ESU, threatened Central Valley spring-run Chinook salmon ESU, threatened Central Valley steelhead Distinct Population Segment, and the designated critical habitats for Central Valley spring-run Chinook salmon and threatened Central Valley steelhead.

III. EFFECTS OF THE ACTION

The overall effect to Pacific salmon EFH from the proposed Coleman National Fish Hatchery Fish Barrier Weir and Ladder Modification project is expected to be beneficial, as the net goal is to increase the availability of high-quality spawning and rearing habitat in upper Battle Creek. In the immediate future, maintaining isolation between the spring and fall Chinook salmon spawning populations will retain the genetic integrity of both runs, as restoration in upper Battle Creek is being implemented. Short-term adverse impacts are expected to result from project construction, including temporary habitat disturbance from the operation of equipment and placement of gravel in the stream channel, and temporary loss of riparian vegetation.

IV. CONCLUSION

Upon review of the best available information, NMFS believes that the proposed Coleman National Fish Hatchery Fish Barrier Weir and Ladder Modification project may temporarily adversely affect EFH for Pacific salmon protected under the MSA.

V. EFH CONSERVATION RECOMMENDATIONS

NMFS believes that conservation measures may be implemented in the project area, as addressed in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). NMFS anticipates that implementing those conservation measures intended to minimize disturbance to habitat and sediment and pollutant inputs to waterways would benefit Chinook salmon and other special species identified in the project area.

Bank Stabilization –The installation of riprap or other streambank stabilization devices can reduce or eliminate the development of side channels, functioning riparian and floodplain areas and off channel sloughs. In order to minimize these impacts, it is recommended that to the extent possible, USFWS:

- use vegetative methods of bank erosion control whenever feasible. Hard bank protection should be a last resort when all other options have been explored and deemed unacceptable.

Road Building and Maintenance – Roads can affect the routing of water by intercepting subsurface flow and diverting it down drainage ditches, effectively increasing drainage density within a watershed. Road construction may result in water being routed more quickly into the streams that might otherwise drain to springs and streams along the valley floor. Altering the connection between surface and groundwater can affect water temperatures, instream flows and nutrient availability. These factors can affect egg development, the timing of fry emergence, fry survival, aquatic diversity and salmon growth. Soil compaction can increase water flow runoff rates and increase movement of instream gravel and cobble, indirectly increasing mortality of salmon eggs, alevins, or fry by carrying them downstream and away from stream cover.

Alterations in stream flow also can alter the timing of life cycle migrations. In order to minimize these impacts, it is recommended that to the extent possible, USFWS:

- locate project access roads out of the floodplain and align them so as not to separate high water channels or winter flooded wetlands from the active waterway.

- locate project access roads out of high erosion hazard areas; and,

- design project access roads to conform to the topography of the land and thereby minimize alterations of natural conditions

Habitat Restoration Projects – Measures undertaken to conserve salmon EFH have the potential to be affected by habitat restoration associated-activities. In order to minimize these impacts, it is recommended that to the extent possible, USFWS:

- protect the Battle Creek watershed's habitat-forming processes (e.g., riparian community succession, bedload transport, runoff pattern) that maintain the biophysical structure and function of aquatic ecosystems;

- take care to utilize or mimic to the greatest extent possible the size and composition of material that would occur at the site naturally, the locations where the material is most likely to enter the channel and stabilize, and the ability of structures to interact dynamically with water flow, streambed, and streambanks;

- limit the use of exotic materials such as wire mesh and geotextile fabrics, and use a minimum of anchoring to the streambed or streambanks; and,

- monitor and evaluate all habitat restoration activities for sustained biophysical process and function.

Gravel Mining – Excavation of gravel may directly eliminate the amount of gravels available for spawning if the extraction rate exceeds the deposition rate of new gravels in the system. Sedimentation may be a delayed impact as gravel removal would occur outside of the current hydrology, when the stream had the least capacity to transport the fines out of the system. By possibly making the stream channel wider and shallower, the suitability of stream reaches as rearing habitat for juveniles may be decreased, especially during summer low-flow periods when deeper waters are important for survival. In order to minimize project impacts, it is recommended that to the extent possible, USFWS:

- strictly limit gravel extraction so that gravel recruitment and accumulation rates are sufficient to avoid affecting gravel recruitment downstream, stream bed profiles either upstream or downstream, or fish habitat;

- not wash extracted aggregates directly in the creek or within the riparian zone;

- include measurements of turbidity levels during operations (with operations to cease if turbidity maximum maximums are reached) and during higher water flow conditions, in the monitoring and reporting of any environmental impacts of gravel removal;

- avoid or minimize damage to stream/river banks and riparian habitats during gravel extraction process. Operations should be planned and designed to minimize the areal extent and depth of extraction (deep holes should be avoided);

- restore gravel extraction areas immediately after the final removal. Assure bonding is in place to guarantee timely mitigation effectiveness and monitoring. Removal or disturbance of trees, rootwads and rocks providing instream roughness elements during gravel extraction activities should be avoided, and those that are disturbed should be replaced or restored; and,

- carry out aggregate recycling whenever possible to reduce the demand for stream gravel resources.

Wood Debris/Structure Removal from Rivers and Estuaries – Large woody debris (LWD) provides habitat complexity such as plunge, lateral, scour and backwater pools, short riffles, undercut banks, side channels and backwaters, to stream channels that allows multiple salmon species and life stages to coexist. LWD creates resting and holding habitat for upstream migrating adult salmon and rearing juveniles, and also serve an ecological function within the stream system itself. Large rocks and boulders are also important structures as they create hydrologic and stream channel complexity important to salmon. In order to minimize project impacts, it is recommended that to the extent possible, USFWS:

- avoid removing woody debris and large rocks and boulders in salmon EFH. Should LWD, snags, large rocks and other natural structure be removed in order to carry out instream construction, they should be put back into place as close as possible to the removal sites upon completion of instream work.

VI. ACTION AGENCY STATUTORY REQUIREMENTS

The Magnuson-Stevens Act and Federal regulations (50 CFR § 600.920) to implement the EFH provisions of the MSFCMA require federal action agencies to provide a written response to EFH Conservation Recommendations within 30 days of its receipt. A preliminary response is acceptable if final action cannot be completed within 30 days. Your final response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity. If your response is inconsistent with our EFH Conservation Recommendations, the USFWS must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

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